PBK Architects Florida, Inc. | West Palm Beach | 2047 Vista Parkway, West Palm Beach, Florida 33411

MURRAY MIDDLE SCHOOL MODERNIZATION

Martin County School District

PROJECT NUMBER: 25064.00

4400 SE MURRAY STREET, STUART, FL 34997

100% CONSTRUCTION DOCUMENTS – 2026/05/25



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CLIENT PROJECT NUMBER: PO # 5182600045

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MURRAY MIDDLE SCHOOL MODERNIZATION

MARTIN COUNTY SCHOOL DISTRICT

PROJECT NUMBER: 25064.00

4400 SE MURRAY STREET, STUART, FL 34997

100% CONSTRUCTION DOCUMENTS – 2026/05/25

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SECTION 00 01 07.1 - SEALS PAGE - ARCHITECT

PART 1 GENERAL

1.1 DESIGN PROFESSIONAL - ARCHITECT OF RECORD

Name and Florida License No.: Antonio Miragaya, AIA, # AR102545

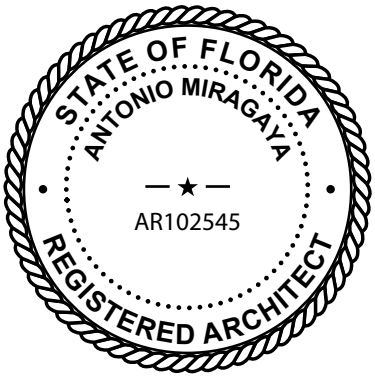
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SECTION 00 01 07.2 - SEALS PAGE - STRUCTURAL

PART 1 GENERAL

1.1 DESIGN PROFESSIONAL - STRUCTURAL ENGINEER OF RECORD

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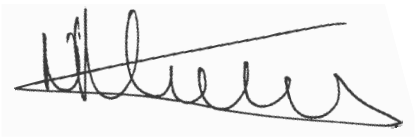
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SECTION 00 01 07.3 - SEALS PAGE - MECHANICAL / PLUMBING

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1.1 DESIGN PROFESSIONAL - MECHANICAL ENGINEER OF RECORD

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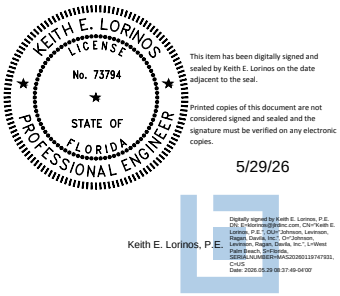
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SECTION 00 01 07.4 - SEALS PAGE - ELECTRICAL

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1.1 DESIGN PROFESSIONAL - ELECTRICAL ENGINEER OF RECORD

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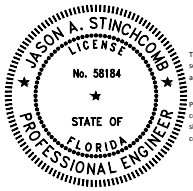
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5/29/26

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PART 1 GENERAL

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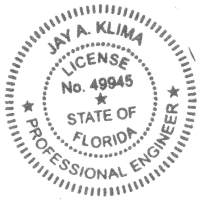
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PART 1 GENERAL

1.1 EXISTING CONDITIONS

A. Certain information relating to existing surface and subsurface conditions and structures is available to bidders but will not be part of Contract Documents, as follows:

B. Geotechnical Report: Entitled Report of Geotechnical Engineering Services, dated February 18, 2026.
   1. This report identifies properties of below grade conditions and offers recommendations for the design of foundations, prepared primarily for the use of Architect.
   2. The recommendations described shall not be construed as a requirement of this Contract, unless specifically referenced in Contract Documents.
   3. This report, by its nature, cannot reveal all conditions that exist on the site. Should subsurface conditions be found to vary substantially from this report, changes in the design and construction of foundations will be made, with resulting credits or expenditures to the Contract Price accruing to Owner.

C. Drainage Report: Entitled "Environmental Resource Permit (ERP) Application", dated February 2026.
   1. This report identifies the proposed drainage design, which includes stormwater management system components, mapped soil types, and stormwater runoff discharge locations, prepared for the South Florida Water Management District (SFWMD) Environmental Resource Permit Application.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

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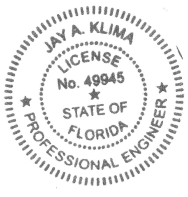
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MURRAY MIDDLE SCHOOL ADDITIONS

ENVIRONMENTAL RESOURCE PERMIT (ERP) APPLICATION

Prepared By:
Klima Weeks Civil Engineering, Inc.
385 Douglas Avenue, Suite 2100
Altamonte Springs, Florida 32714 (407) 478-8750
Certificate of Authorization # 9230

February 2026



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Murray Middle School Additions
SFWMD Environmental Resource Permit Application

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Murray Middle School Additions
SFWMD Environmental Resource Permit Application

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2. Hydraulic/Hydrologic and Recovery Calculations
3. Nutrient Load Reduction Analysis
4. ICPR Routing Analyses

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SECTION 1

EXECUTIVE SUMMARY

1.1 PROJECT INFORMATION

1.1.1 Project Applicant

Name: Mark Sechrist, Director
Martin County School District
Address: 1939 SE Federal Highway Stuart, FL 34994
Telephone: 772-219-1200
Email: sechrim@martinschools.org

1.1.2 Project Name and Location

Project Name: Murray Middle School Additions
Project Location: 4400 SE Murray St Stuart, FL 34997

1.2 GENERAL PROJECT DESCRIPTION

Martin County School District (MCSD) is planning to construct a new classroom building in the place of several buildings recently demolished on the east side of the Murray Middle School campus. The parking lot and driveway will be expanded, as well. The proposed project area is 4.7 acres and the proposed impervious area to be placed is approximately 2.5 acres.

Permit 050701-13 authorized construction of a parking lot along the west property boundary of the campus, with a single dry detention pond for stormwater treatment and attenuation. Permit 070524-27 authorized construction of a classroom building addition near the northwest corner of the campus, with a single dry retention pond for stormwater treatment and attenuation.

The proposed stormwater management system will consist of the existing ponds and two new ponds to serve the classroom building and parking lot additions, respectively. The system will continue to discharge into the Murray Street right-of-way as previously permitted.

The project is within the HUC 12 Basin 030902060503, with the receiving waterbody being Manatee Pocket. There are no Outstanding Florida Waters within this basin. Manatee Pocket is impaired for nutrients, and is included in the "St. Lucie River and Estuary Basin Management Action Plan" of June 2025 (South Mid-Estuary sub-basin).

Water, Sewer, and Reclaimed Water (if available) services will continue to be provided by Martin County Utilities.

1.3 SUMMARY OF AGENCY DESIGN CRITERIA

South Florida Water Management District (SFWMD)

Nutrient load reduction is required per Section 8.3 of the Applicant's Handbook, Volume I.

The lowest road/parking lot elevation must be at or above the maximum stage in the proposed pond during the 10-year, 24-hour storm event. The lowest finished floor elevation must be above the maximum stage in the proposed pond during the 100-year, 72-hour storm event.

No net encroachment into the floodplain, between the average wet season water table and that encompassed by the 100-year event, which will adversely affect the existing rights of others, will be allowed. Provision must be made to replace or otherwise mitigate the loss of historic basin storage provided by the project site.

As the site has a positive outfall, peak discharge rate attenuation for the 25-year, 72-hour storm event is required per current SFWMD policy.

Operation and Maintenance documentation is required per Sections 12.3.5 and 12.4.1 of the Applicant's Handbook, Volume I.

1.4 DRAINAGE DESIGN

The design of the proposed stormwater management system is based on meeting SFWMD criteria for nutrient load reduction, peak discharge attenuation, and maximum stages. The system design is primarily based on the required nutrient load reduction volume. The system design also provides peak discharge attenuation for the 25-year, 72-hour storm event and the required maximum stages for the 100-year, 72-hour and 10-year, 24-hour storm events are met.

Overview

The pre-development conditions dictate the initial conditions that constrain the design of the proposed stormwater management system. Those conditions assume the continuation of discharge from the school campus into the Murray Street stormsewer system.

The Murray Street stormsewer system has both direct and indirect inflows from the school campus. The direct flows are from those portions of the campus adjacent to the street. The indirect flows are from the ditches along the east, south, and west property boundaries and any pumped discharges or any sheetflow to other areas that ultimately drain to Murray Street.

The mapped soil types are primarily A/D (with pockets of HSG A), but given the drained condition of the site as evidenced by the surrounding ditches and the extensive soil boring data, the pre- and post-development soils are considered to be HSG A in accordance with guidance from the NRCS.

The flow path from the Murray Street stormsewer system to the receiving waterbody, Manatee Pocket, includes the stormsewer system from the intersection of Murray Street and SE 45th Avenue north to the upstream end of a canal on the north side of SE Cove Road. The canal flows north and east through a forested wetland then under the railway and roadway bridges into the southwest end of Manatee Pocket at SE Anchor Way.

See the Flow Path to Manatee Pocket exhibit included with the Pre- and Post-Development Basin Maps in Attachment 1.

Pre-Development Condition

In the pre-development condition, all stormwater runoff eventually flows into the Murray Street system (Permit 050701-13). To assist in designing the proposed system, five basins (Basins A – E) were identified and delineated to model the pre-development conditions:

Pre-Development Basins

Basin	Location	Area	Pond Type
A	Existing Parking Lot, Driveway	1.53 ac	NA
B	Permitted Building Addition (070524-27)	1.49 ac	Retention
C	Center of Campus, Buildings and Courtyards	1.42 ac	NA
D	Permitted Parking Lot Addition (050701-13)	4.38 ac	Dry Detention
E	Remaining Campus Area (East and South)	8.33 ac	NA
TOTAL		**17.15 ac**	

Basin A (Pre)

Stormwater runoff from the existing parking lot and driveway sheetflow directly into the Murray Street right-of-way without treatment or attenuation.

Basin B (Pre)

Stormwater runoff from the permitted building addition (070524-27) and surrounding areas (pervious and impervious) within the basin is conveyed to a dry retention pond designed for treatment and attenuation. The pond discharges via an outfall structure into a stormwater bypass trunk line (see Basin C (Pre) below) that connects to the Murray Street stormsewer system.

Basin C (Pre)

Stormwater runoff from this basin, consisting of buildings and courtyards (no vehicular traffic), is collected and conveyed directly to the Murray Street stormsewer system without treatment or attenuation via a stormwater bypass trunk line.

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Basin D (Pre)

Stormwater runoff from the permitted parking lot addition (050701-13) and much of the surrounding areas (mostly pervious) within the basin is conveyed to a dry detention pond. The remainder of the basin sheetflows to the south into a ditch along the south property boundary. The pond discharges through a 6" X 30" slot in a "baffle box" set at the pond bottom elevation to a ditch along the west property boundary. The south ditch discharges into the west ditch, which discharges into the Murray Street stormsewer system. Given the pond type and method of discharge, stormwater runoff from this basin is presumed to be discharged offsite with little or no treatment or attenuation.

Basin E (Pre)

This basin primarily covers the remaining eastern half of the school campus. Prior to 2015 there were eight buildings (and at one time a portable building) within the northern portion of this basin. Stormwater runoff from the buildings and associated walkways and courtyards was collected and conveyed offsite via a stormsewer system without treatment or attenuation.

Based on older surveys, a "Catch Basin Pump" apparently pumped a portion of building stormwater runoff to an unknown location for offsite discharge, which most likely would be the onsite ditch along the southern half of the east property boundary. The most recent survey indicates that stormwater runoff from Buildings 9 and 10 to the south is collected in downspouts that discharge into bubble-up structures near the south property line. Most of the basin, however, also discharges offsite without treatment or attenuation via yard drains, inlets, and pipes with connection to the Basin C stormwater bypass trunk line.

Post-Development Condition

In the post-development condition, two ponds are added to the existing stormwater management system. At the same time, the impervious area is decreased by the proposed removal of existing buildings and previously removed buildings and other impervious in 2015.

Post-Development Basins

Basin	Location	Area	Pond Type
A	Proposed Parking Lot, Driveway Additions	2.38 ac	Rain Garden
B	Remainder of Pre-Development Basin B	1.24 ac	Retention
C	Center of Campus, Buildings and Courtyards	1.42 ac	NA
D	Permitted Parking Lot Addition (050701-13)	4.38 ac	Dry Detention
E, North	Proposed Building Addition	2.16 ac	Retention
E, South	Remainder of Pre-Development Basin E	5.56 ac	NA
TOTAL		**17.15 ac**	

Basin A (Post)

With the proposed driveway and parking additions, the basin area is increased from pre-development. A rain garden with an underdrain (Pond A) is proposed for nutrient load reduction. Pond A will receive discharge from Pond E and will discharge offsite into the Murray Street right-of-way.

Basin B (Post)

The increase in basin area of Basin A reduces the basin area of Basin B. The removal of the northernmost building on the campus within Basin B also reduces the impervious area of Basin B. No impervious area is to be placed within, and no modification to the existing stormwater management system is proposed for, Basin B.

Basin C (Post)

The delineation and basin area of Basin C in pre-development remains unchanged. No impervious area is to be placed within, and no stormwater management system is proposed for, Basin C.

Basin D (Post)

The delineation and basin area of Basin D in pre-development remains unchanged. No impervious area is to be placed within, and no stormwater management system is proposed for, Basin D.

Basin E (Post)

The increase in basin area of Basin A reduces the basin area of Basin E. The removal of the northernmost building on the campus within Basin B also reduces the impervious area of Basin E. The addition of a new classroom building, walkways, and fire access road requires a pond (Pond E) for treatment and attenuation of stormwater runoff within that portion of Basin E (Basin E, North). No impervious area is to be placed within, and no stormwater management system is proposed for, the remainder of Basin E (Basin E, South).

Basin E, North (Post)

Stormwater runoff from the proposed development in the northern portion of Basin E will be treated and attenuated in as a dry retention pond. The pond will discharge into Pond A as explained above.

Basin E, South (Post)

The remainder of Basin E that will not be developed will continue to sheetflow into ditches to the south and east as in the pre-development condition.

See Attachment 1 for Pre- and Post-Development Basin Maps.

Nutrient Load Reduction

Pre- and Post-Development BMPTrains models were created to demonstrate that the overall Total Nitrogen (TN) and Total Phosphorus (TP) loads discharged to the receiving waterbody are attenuated pre-/post- and meet the minimum nutrient load reduction of 80% for both TP and TN.

Note that the pre-development impervious area associated with portables and walkways not previously permitted were excluded from the calculations and analyses. Likewise, the eight buildings previously removed were also excluded from the calculations and analyses in accordance with the definition of "Predevelopment condition" in Section 2.0, ERP AH Volume I.

Basin A (Post)

A rain garden with an underdrain (Pond A) is proposed for nutrient load reduction. Pond A will have a media mix of a minimum 24" of IFGEM (Iron Filings – Green Environment Media) below the pond and above the underdrain gravel envelope. Pond A will receive discharge from Pond E. Pond A and Pond E together will provide in excess of 80% nutrient load reduction for their basin areas.

Basin B (Post)

The increase in basin area of Basin A reduces the basin area of Basin B. The removal of the northernmost building on the campus within Basin B also reduces the impervious area of Basin B. No impervious area is to be placed within, and no stormwater management system is proposed for Basin B. As such, this basin was excluded from the analysis. .Nonetheless, there is a net increase in nutrient load reduction from this basin.

Basin C (Post)

The delineation and basin area of Basin C in pre-development remains unchanged. No impervious area is to be placed within, and no stormwater management system is proposed for, Basin C. As such, this basin was excluded from the analysis.

Basin D (Post)

The delineation and basin area of Basin D in pre-development remains unchanged. No impervious area is to be placed within, and no stormwater management system is proposed for, Basin D. As such, this basin was excluded from the analysis.

Basin E (Post)

A dry retention pond (Pond E) is proposed for nutrient load reduction. Pond A will receive discharge from Pond E. The Pond E storage capacity was optimized to ensure that Pond A and Pond E together will provide in excess of 80% nutrient load reduction for their basin areas.

The following table shows the results from the BMPTrains model with their respective TN and TP loadings for Basins A and E (Pre) and Basins/Ponds A and E (Post).

Nutrient	Pre-Development Loading	Post-Development Loading	Percent Reduction
Total Nitrogen	11.03 kg/yr	2.29 kg/yr	82 %
Total Phosphorus	2.253 kg/yr	0.26 kg/yr	90 %

Peak Stages and Peak Discharges

Peak Discharges

With respect to peak discharges, the analysis considered existing impervious area and pond storage versus proposed impervious area and pond storage both campus-wide and basin-specific. Only Basins A, B, and E were affected by the proposed development, and there is a significant reduction in impervious area to Pond B given the proposed modifications.

Campus-wide impervious area decreases from 311,760 sf (7.16 ac) to 277,289 sf (6.37 ac). Campus-wide pond storage increases from 0.08 ac-ft for existing Pond B to 0.77 ac-ft for Pond B and proposed Ponds A and E combined, which provides treatment and attenuation of basins that had no treatment or attenuation in pre-development.

Although Basin A increases somewhat in area, which previously discharged offsite without treatment or attenuation, the proposed Pond A will provide attenuation (in the 25-year, 72-hour storm event) in excess of District criteria. Likewise, the portion of Basin E served by the proposed Pond E (in conjunction with proposed Pond A) will provide attenuation not previously provided and also in excess of District criteria.

Finally, note that there have been no modifications to the stormsewer systems in the flow path to the receiving waterbody since the assumed pre-development condition.

Peak Stages

Peak stages in the proposed ponds for the 100-year, 72-hour, 25-year, 72-hour and 10-year, 24-hour storm events are below top of bank for each proposed pond. Peak stages in the proposed ponds are also below the lowest finished floor and parking lot/roadway inlet elevations.

Model results for the 100-year, 72-hour and 10-year, 24-hour storm event peak stages are shown in the tables below, with comparison to building finished floor elevation and lowest parking lot inlet elevation as applicable (no parking lot/roadway in Basin SE):

For Ponds B and D, the previously permitted stages in their respective ponds are conservatively assumed to remain unchanged.

Basin / Pond	100-year, 72-hour Peak Stage	Lowest Finished Floor Elevation
Pond A (Parking)	11.27 ft, NAVD	NA*
Pond E (Bldg)	12.59 ft, NAVD	13.50 ft, NAVD

Basin / Pond	10-year, 24-hour Peak Stage	Lowest Parking Lot/Roadway Elevation
Pond A (Parking)	11.18 ft, NAVD	11.50 ft, NAVD
Pond E (Bldg)	11.72 ft, NAVD	NA*

* Not Applicable. No buildings in Basin A (Parking); no parking lot/roadway in Basin E (Bldg)

1.5 SURFACE AND GROUNDWATER ELEVATIONS

1.5.1 Surface Elevations

Surface elevations are relatively flat, requiring yard drains, catch basins, and stormsewer systems to eventually direct discharge to either the nearest surrounding ditch and/or the Murray Street stormsewer system.

1.5.2 Groundwater Elevations

The geotechnical report states that the estimated seasonal high groundwater elevations are 3 feet above measured groundwater elevations. The measured groundwater elevations represent the seasonal low groundwater elevation, based on a phone conversation with the geotechnical engineer. According to South Florida Water Management District policy, the average wet season water table is one foot below the estimated seasonal high groundwater elevation.

Attachment 2 includes soils and groundwater information from the geotechnical report and specific to the proposed ponds, as applicable. Calculations based on the soils and groundwater information are also included to determine the input parameters for the recovery analyses (including underdrain design) in the PONDS models (also included in Attachment 2).

1.6 100 YEAR FLOODPLAIN ANALYSIS

This project site is not located within a 100-year floodplain as determined from the FEMA Flood Insurance Rate Map.

1.7 WETLANDS/SURFACE WATERS

Upland-cut ditches exist along the east, south, and west property boundaries of the campus, but no work is proposed in or near them. No wetlands or other surface waters are within the subject site.

SECTION 2

PRE-DEVELOPMENT AND POST-DEVELOPMENT CONDITIONS

2.1 OUTFALL FOR POINT DISCHARGES

In post-development, as in the permitted pre-development condition, all stormwater runoff eventually flows into the Murray Street system (Permit 050701-13).

2.2 ON-SITE AND OFF-SITE STORMWATER MANAGEMENT SYSTEMS

The proposed stormwater management system will be wholly contained on-site.

2.3 TAILWATER CONDITIONS

The maximum tailwater elevation for surface discharge from Pond A, the proposed parking lot/driveway expansion pond, is the high elevation in the swale to the west of Pond A in the Murray Street right-of-way (center line of swale (CLS) elevation of 10.5 ft, NAVD). This point is just downstream of the Pond A overflow weir. Elevations continue to drop from this point to the cross-drain mitered end section (18" RCP, invert elevation 8.93 ft, NAVD) at the intersection of Murray Street and SE 45th Avenue.

The maximum tailwater elevation for surface discharge from Pond E, the proposed building addition pond, is the maximum water surface elevation in its point of discharge, Pond A. This tailwater elevation was considered in the design of Pond E and its outfall structure in the ICPR analysis.

The maximum tailwater elevation for groundwater discharge from the Pond A underdrain is conservatively assumed to be the crown of pipe elevation, 4.82 ft, NAVD, at the point of connection with the existing Basin C stormwater bypass trunk line (an existing manhole north of Pond B). The tailwater elevation was considered in the PONDS underdrain analysis.

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SECTION 3

DESIGN ANALYSIS

3.1 HYDRAULIC PARAMETERS

Drainage basin areas were delineated using survey information and proposed grading plans. Existing and proposed impervious areas were also delineated and calculated. Soil Types (Hydrologic Soil Groups) and land use coverage within each basin were then identified. These areas and sub-areas within each land use were considered in determining hydraulic parameters with respect to both Nutrient Load Reduction (NLR) and Peak Discharge Attenuation in both Pre-Development and Post-Development.

Note that the mapped soil types are primarily A/D (with pockets of HSG A), but given the drained condition of the site as evidenced by the surrounding ditches and the extensive soil boring data, the pre- and post-development soils are considered to be HSG A in accordance with guidance from the NRCS.

According to the NRCS National Engineering Handbook (NEH) Chapter 7, "Hydrologic Soil Groups", a soil may be classified as HSG A if it meets the following criteria:

Depth to Base of Aquifer > 40 inches
Depth to High Groundwater Table > 40 inches
Ksat (minimum) > 1.42 in/hr

According to the Geotechnical Report, of the 18 soil borings taken across the campus, all showed SP and SP-SM (moderately drained to well drained) soils to a depth of at least 15 feet (180 inches). Of those, 14 soil borings had a measured depth to groundwater of 7 feet, 3 soil borings had a measured depth to groundwater of 6 feet, and one had a measured depth of only 4 feet. Given the estimated seasonal high groundwater table estimated at 3 feet above measured, the average high groundwater table depth was 3.67 feet (44 inches). Of the soil borings with permeability values the lowest measured permeability was 8.1×10^{-5} cfs/sf or 7 feet/day (14 in/hr).

Given the geotechnical consultant's data, calculations, and estimation, along with the existence of drainage systems (surrounding ditches, onsite detention pond) located on the property, it is appropriate to consider the onsite soils to not be HSG A/D soils in their undrained condition, but HSG A soils in their drained condition.

The land uses in place at the time of permit application are Low Intensity Commercial, the land use category applicable to schools. As there are many yard and drainage inlets throughout a school campus, which is typical for current school drainage system design, it was also appropriate to consider almost all impervious area as DCIA. As such, the nDCIA CN values primarily reflect the

CN values for the pervious areas. The Hydraulic/Hydrologic Calculations section of this report includes calculations of the DCIA and Non-DCIA areas as well as the DCIA Percent and Non-DCIA CN for use in the NLR analyses.

3.2 NUTRIENT LOAD REDUCTION (NLR) ANALYSIS

Nutrient load reduction is achieved by a treatment train of wet detention and dry retention ponds in both the Northern and Southern Basins/Ponds systems. BMPTrains was used to demonstrate that the post-development discharge of both Total Nitrogen and Total Phosphorus met the applicable requirements of Section 8.3 of the Applicant's Handbook Volume I. The BMPTrains model input and output report are included in the Hydraulic/Hydrologic Calculations section of this report.

3.3 STAGE VS. STORAGE

Stage vs. storage calculations demonstrate storage of the required nutrient load reduction and peak discharge attenuation volumes. See the Hydraulic/Hydrologic Calculations located in Attachment 2 of this report for more information.

3.4 RECOVERY ANALYSIS

Recovery calculations demonstrate recovery of the required water quality treatment volumes and attenuation volumes within the required time. See the PONDS recovery analyses in Attachment 2 of this report for more information.

Attachment 2 includes soils and groundwater information from the geotechnical report and specific to the proposed ponds, as applicable. Calculations based on the soils and groundwater information are also included to determine the input parameters for the recovery and underdrain analyses.

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SECTION 4

OPERATION AND MAINTENANCE

The on-site improvements will be owned and operated by the owners of the property, who will perform routine maintenance as required to keep the ponds mowed, free of debris and operating properly.

In accordance with Sections 12.3.5 and 12.4.1, ERP AH Vol 1, a Certificate of Financial Capability with a Cost Estimate of Operation and Maintenance Costs will be provided to the final property owner/permittee.

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FIGURES

FIGURE 1

USGS QUAD MAP

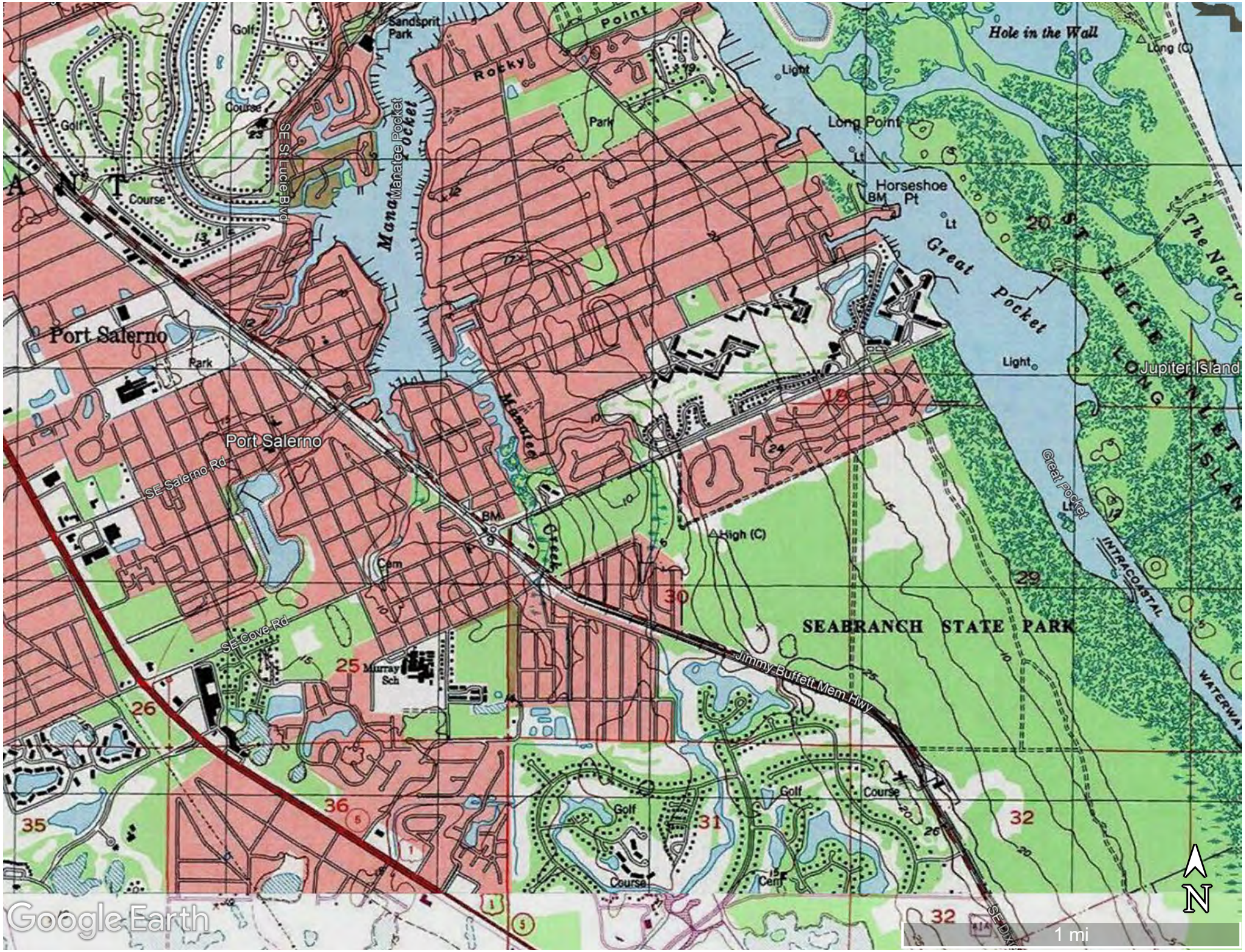

Port Salerno
Port Salerno
Sandsprit Park
Rocky Point
Hole in the Wall
Long (C)
Light
Golf Course
Golf Course
Manatee Pocket
SE Lucerne Blvd
Park
Long Point
Lt
Horseshoe Pt
BM
Lt
Great Pocket
Light
Jupiter Island
The Narrows
ST LUCIE INLET
LONG ISLAND
Park
SE Salerno Rd
Manatee Creek
BM
High (C)
Great Pocket
Lt
INTRACOASTAL WATERWAY
Cem
SE Cove Rd
SEABRANCH STATE PARK
Murray Sch
Jimmy Buffett Mem Hwy
Golf Course
Golf Course
Cem
SE Dixie
1 mi
N
Google Earth

FIGURE 2

VICINITY MAP


Manatee Pocket
SE St Lucie Blvd
Port Salerno
SE Salerno Rd
SE Cove Rd
Jimmy Buffett Mem Hwy
Great Pocket
Jupiter Island
Google Earth
N
1 mi

FIGURE 3

AERIAL MAP


SE Field St
SE Field St
SE 46th Ave
SE 45th Ave
SE 44th Ave
SE Murray St
SE Murray St
SE Murray Cove Cir
SE Murray Cove Cir
SE Wesley Ave
SE 47th Ave
SE Cleckley St
Google Earth
N
700 ft

FIGURE 4

SOILS MAP



Map Scale: 1:2,160 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 30 60 120 180

Feet: 0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Martin County, Florida
Survey Area Data: Version 24, Aug 29, 2025

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jan 21, 2021—Feb 4, 2021

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
4	Waveland and Immokalee fine sands	A/D	17.7	90.8%
41	Jonathan sand, 0 to 5 percent slopes	A	1.8	9.2%
Totals for Area of Interest			**19.5**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

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FIGURE 5

HUC 12 BASIN MAPS
AND BASIN DATA


Manatee Pocket
Railroad/Roadway Bridge Connection
Canal to Manatee Pocket
SE 45th Ave Stormsewer
Discharge from Bypass System and Pond B
Discharge from Parking Lot, etc.
Discharge from East, South, and West Perimeter Ditches
SE Seaward St
SE Commerce Ave
SE Railway Ave
SE Horseshoe Point Rd
SE Great Pocket Trail
SE Manatee Cove Rd
SE Hanson Cir
SE Cove Rd
SE Salerno Rd
SE Broward St
SE Lincoln St
SE Grant St
SE Channel Dr
SE Driftwood Ave
SE Anchor Ave
SE Bollard Ave
SE Front Ave
SE 46th Ave
SE 45th Ave
SE 44th Ave
SE Field St
SE Murray St
SE Lee St
SE Jack Ave
SE Alicia St
SE 52nd Ave
SE 52nd Dr
SE 53rd Ave
SE Primrose Way
Jimmy Buffett Mem Hwy
Arthur St
SE Katharine Ave
SE Colee Ave
SE Del St
SE Windsong Ln
SE Cleckley St
Google Earth
Image © 2026 Vexcel Imaging US, Inc.
N
2000 ft

Final

St. Lucie River and Estuary Basin Management Action Plan

Division of Environmental Assessment and Restoration
Water Quality Restoration Program
Florida Department of Environmental Protection

with participation from the
St. Lucie River and Estuary Stakeholders

June 2025

2600 Blair Stone Road
Tallahassee, FL 32399-2400
https://floridadep.gov/

Exhibit 1

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Executive Summary

Background

The St. Lucie River and Estuary Watershed is located in southeast Florida in Martin, St. Lucie, and Okeechobee counties. It consists of 11 basins (see **Figure ES-1**). The St. Lucie Estuary is a major tributary to the Southern Indian River Lagoon.

The St. Lucie River and Estuary and its associated watershed have been subjected to hydrologic, land use, and other anthropogenic modifications over the past century that have degraded its water quality. To help address the nutrient impairment, the Florida Department of Environmental Protection (DEP) adopted total maximum daily loads (TMDLs) for total nitrogen (TN) and total phosphorus (TP) for the estuary. This BMAP represents the joint efforts of multiple stakeholders to identify where nutrients, both nitrogen and phosphorus, can be reduced through regulatory and non-regulatory programs, incentive-based programs, and implementation of projects that will ultimately achieve and maintain the TN and TP TMDLs in the estuary.

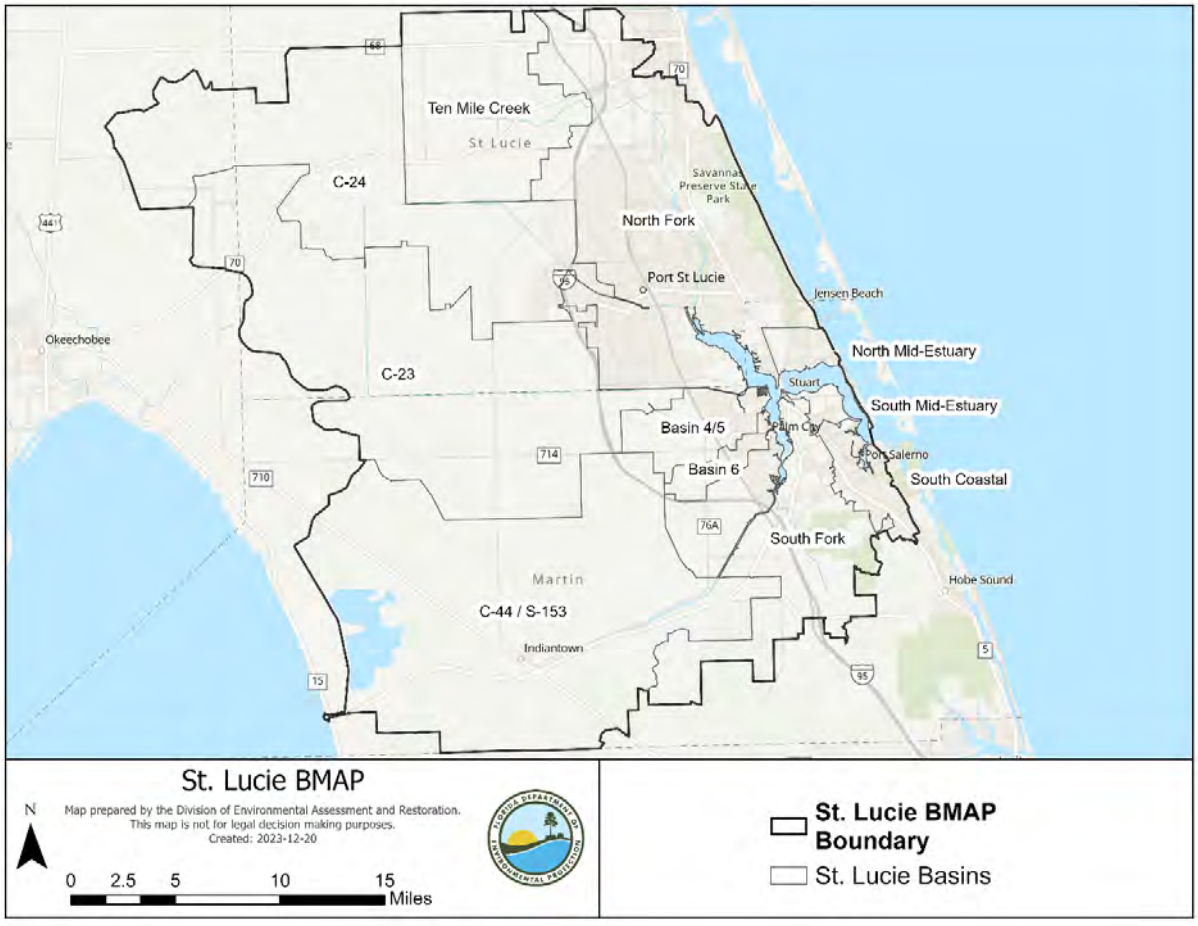


Figure ES-1. St. Lucie River and Estuary BMAP area and basins

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arcgis.com/apps/mapviewer/index.html?layers=48cc2aee7990443bbffab07b845356d5

Untitled map

Sign In

Great Pocket Cove-Willoughby Creek Frontal

Table | Zoom to

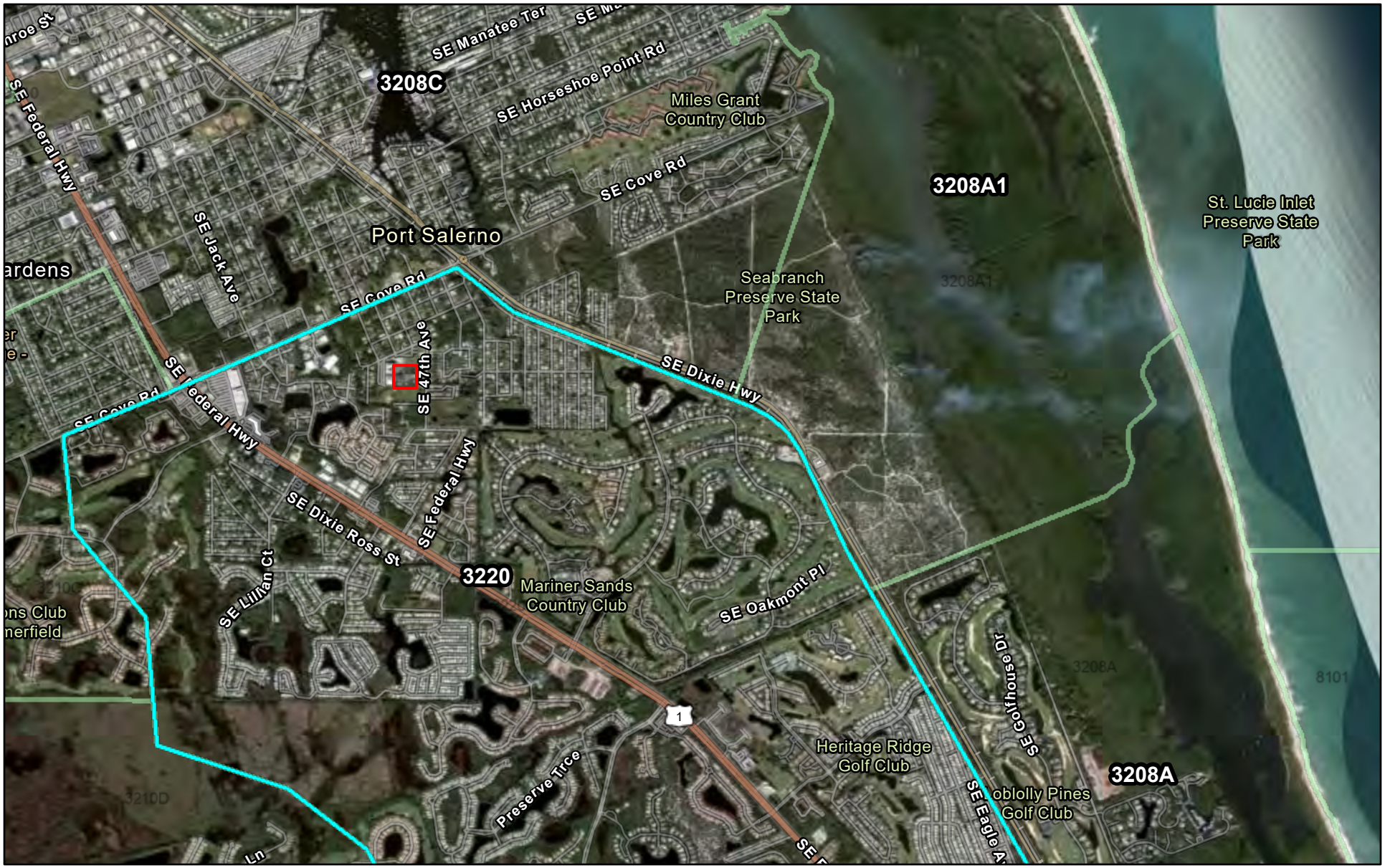
SourceFeatureID	
LoadDate	1/18/2013, 2:08 AM
GNIS_ID	
AreaAcres	9,210.22
AreaSqKm	37.27
States	FL
HUC12	030902060503
Name	Great Pocket Cove-Willoughby Creek Frontal
HUType	Frontal
HUMod	OT,SC
ToHUC	030902060504
NonContributingAreaAcres	0.00
NonContributingAreaSqKm	0.00

State of Florida, Earthstar Geographics | USGS, Florida Dept of Environmental Protection

Powered by Esri

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Standard Map



August 12, 2025

Waterbody IDs (WBIDs)

Group 2

1:36,112

0 0.28 0.55 1.1 mi

0 0.42 0.85 1.7 km

State of Florida, Maxar, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, (c) OpenStreetMap contributors, and the GIS User Community,

Map created by Map Direct, powered by ESRI.

Florida Department of Environmental Protection makes no warranty,expressed or implied,or assumes any legal liability or responsibility for the accuracy,completeness,or usefulness of any information,apparatus,product,or process disclosed,or represents that its use

Standard Map



August 12, 2025

1:72,224

0 0.5 1 2 mi

0 0.75 1.5 3 km

Waterbody IDs (WBIDs)

Group 2

Outstanding Florida Waters

OFW Aquatic Preserves

Other OFWs

FDEP, DEAR, State of Florida, Earthstar Geographics, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, (c) OpenStreetMap contributors, and the GIS User Community, FDEP,DEAR

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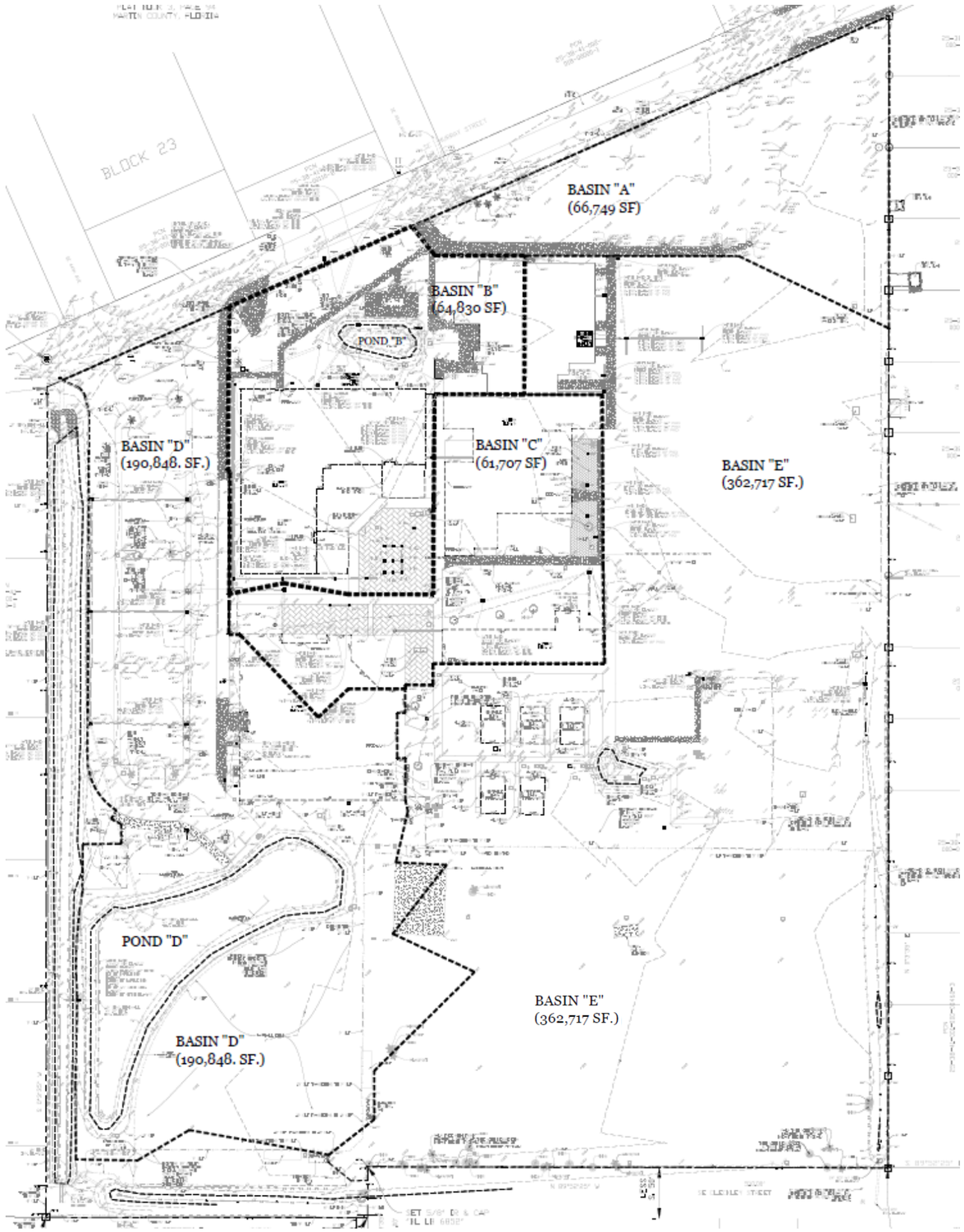
Map created by Map Direct, powered by ESRI.

Florida Department of Environmental Protection makes no warranty,expressed or implied,or assumes any legal liability or responsibility for the accuracy,completeness,or usefulness of any

ATTACHMENT 1

PRE-/POST-DEVELOPMENT BASIN MAPS

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TELEPHONE 407.478.8750
FACSIMILE 407.478.8749

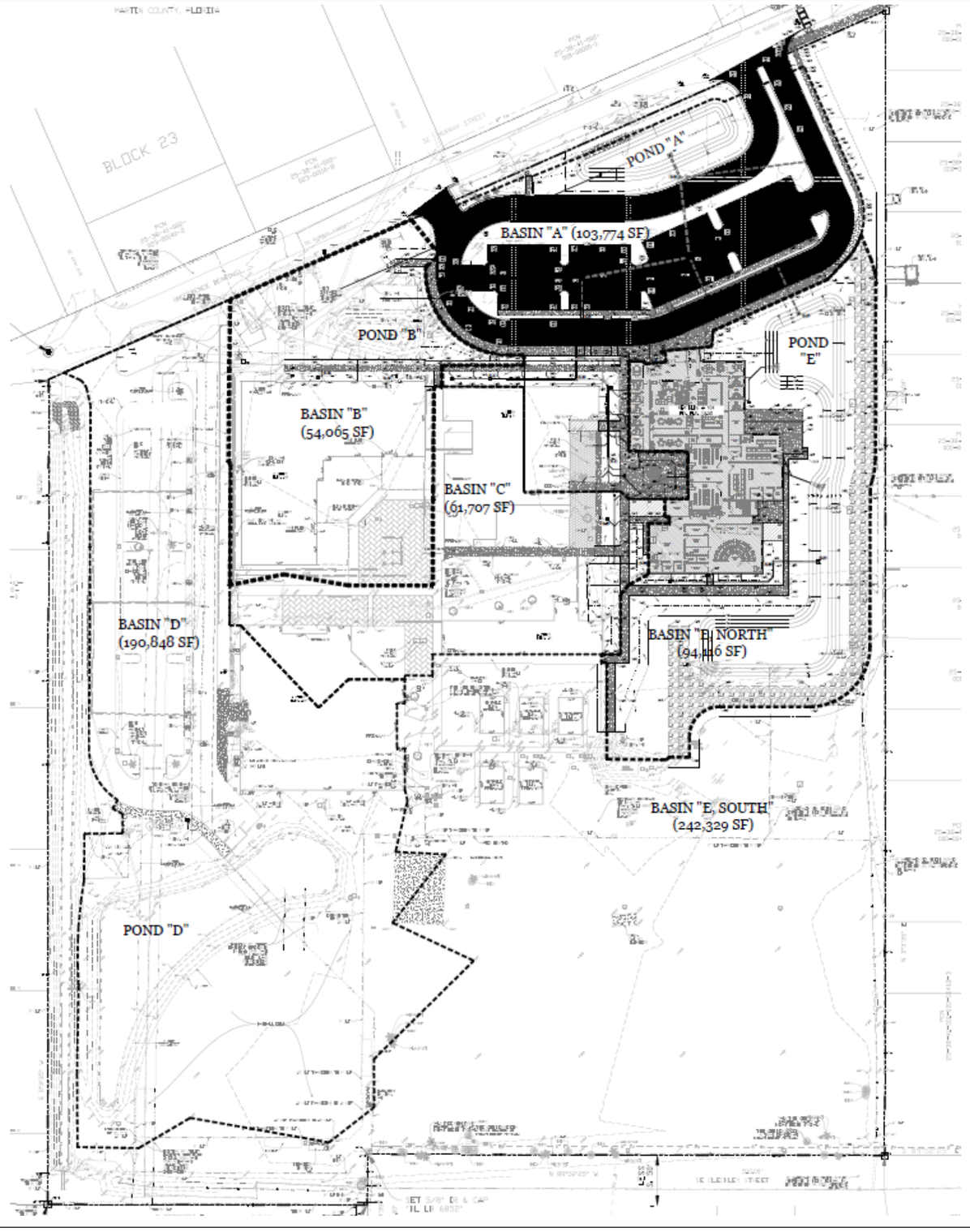
MURRAY MIDDLE SCHOOL ADDITIONS

PRE-DEVELOPMENT BASIN MAP

revision	description	date
△		
△		

drawn by:	KAL
checked by:	KAL
date:	01/23/2026
plot scale:	NTS
project number:	25HARV020

HB ESTIMATING REC'D 06.01.2026



Klima Weeks CIVIL ENGINEERING
385 DOUGLAS AVENUE, STE 2100
ALTAMONTE SPRINGS, FLORIDA 32714
TELEPHONE 407.478.8750
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MURRAY MIDDLE SCHOOL ADDITIONS

POST-DEVELOPMENT BASIN MAP

revision	description	date
△		
△		

drawn by:	KAL
checked by:	KAL
date:	10/23/2024
plot scale:	NTS
project number:	24SCHE163

HB ESTIMATING REC'D 06.01.2026

ATTACHMENT 2

HYDRAULIC/HYDROLOGIC CALCULATIONS

RECOVERY CALCULATIONS

HB ESTIMATING REC'D 06.01.2026

PONDS Underdrain Analysis
Version 3.3.0059
Copyright 2011
Devo Seereeram, Ph.D., P.E.

Job Information

Job Name: Murray MS
Engineer: KAL
Date: 02-10-2026

Input Data

Area at top of pond, [ATOP]:	6848	ft²
Depth of basin, [d]:	3	ft
Aquifer depth below pond bottom, [B]:	11.9	ft
[B] has exceeded maximum, truncated to [Bmax]	*8*	*ft*
Desired depth to water table below pond bottom, [R]:	.5	ft
Hydraulic conductivity of soil, [K]:	40	ft/day
Drain diameter, [D]:	6	in
Thickness of gravel envelope, [t]:	3	in
Thickness of soil cover, [H]:	2	ft
Treatment volume, [PAV]:	11983	ft³
Recovery time, [T]:	3	days
Factor of safety, [FS]:	2	
Background seepage, [qb]:	0	gpm
Free discharge / no tailwater		
Manning's n value for lateral drain pipe, [n1]:	.015	
Manning's n value for main drain pipe, [n2]:	.015	
Slope of lateral drains, [s1]:	.3	%
Slope of main drains, [s1]:	.2	%
Maximum length of single lateral drain, [l]:	200	ft
Maximum percentage of length of laterals connected to the main drain, [P]:	100	%

Results

Computed underdrain spacing, [S]:	59.71609	ft
Computed total length of laterals, [L]:	114.676	ft
Computed flow rate through outfall, [Q]:	9.246142E-02	ft³/sec
Computed flow rate per lineal foot of lateral, [ql]:	8.062843E-04	ft³/sec/ft
Cumulative flow rate for the longest lateral, [qc]:	0.1612569	ft³/sec
Minimum theoretical diameter for longest lateral, [Dl]:	4.978319	in
Minimum theoretical diameter for main pipe, [Dm]:	4.360293	in

HB ESTIMATING REC'D 06.01.2026

Notes

1. Laterals should be no farther than S/2 from the top of the basin.
2. A gravel envelope at least 3 inches thick is recommended around the underdrain pipes. If a gravel envelope is used, a filter fabric will be required around this envelope.
3. The underdrain pipe should have a filter fabric sock to prevent fines from moving into and clogging the perforated pipe.
4. Ensure outfall elevation for system will allow gravity flow without tailwater backpressure to the underdrains.
5. Theory is applicable where ground water flow is largely in a horizontal direction (i.e., natural gradients less than 1%).
6. Capped and sealed inspection and cleanout ports which extend to the ground surface are recommended at the following locations for each drain pipe:
    a. the terminus
    b. at every 400 feet or every bend of 45 or more degrees, whichever is shortest
7. Underdrain basin should be stabilized with permanent vegetative cover.

Warnings

1. Aquifer depth below pond bottom [B] has exceeded maximum value for ellipse theory. Ellipse theory may not be valid. [B] has been truncated to [Bmax] = 8 for calculations.

HB ESTIMATING REC'D 06.01.2026

Appendix A – Media Mixes Datasheet

Media[1]	Minimum	Treatment[2]	Treatment Efficiency[3]		Sustain	OP Removal[5]	Density[6]
	Depth (in)	Rate (GPM/SF)	TN (%)	TP(%)	Void %[4]	Rate (mg/g)	Lbs/CF
B&G ECT3 or ECT	24	1	45/25[7]	45/25[7]	30	0.2	43
IFGEM	24	0.104	80	95	30	0.6	105
User Defined	24	0.104 GPM/SF = 20 feet per day					
B&G CTS12	12		0	90	30	0.2	95
B&G CTS24	24	0.052	75	95	30	0.2	95
Per Pave[8]	3	0.052	60	90	30	0.2	95
SAT[9]	24	0.02	20	45	30	0	100

1. June 2022 commonly used. Others can be included as user defined.
2. Treatment Rate including a factor of safety=2

PONDS already requires FS = 2: Use 40 feet/day

3. Average annual concentration reduction;
   mass reduction is the product of concentration and water passing through filter.
4. Percent of water in the media after loading with stormwater equal to 10 years of operation.
5. Measured dissolved fraction usually as Ortho-Phosphate (OP) in (mg OP/g of media).
6. Dry densities at operating density, will vary with source materials.
7. 45/25 (stand-alone BMP/downstream of another BMP) average annual efficiencies.
8. Limited to the bottom of at least a 12 inch deep pervious pavement reservoir.
9. Limited to a stand-alone BMP or first in a series of BMPs, reflecting particulate removal.

Notes: 1. Average annual concentration reduction values are for a 50% mix of particulates.

2. Efficiencies are for stormwater runoff events with dry periods (no rainfall).
3. Continuous application of runoff may affect the concentration reduction.
4. Species mix for TN has DON less than 20% of the TN.

Note at this time, user defined media are limited in depth to 24".

A - Demonstration Bio Media for Ultra-urban Stormwater Treatment, Wanielista, et.al. FDOT Project BDK78 977-19, 2014
B - Optimal Recipe Assessmenet of Iron-Filing Based..., Valencia, et.al., Environmental Engineering Science, 36, 10, 2019
C - Up-Flow Filtration for Wet Detention Ponds, Wanielista and Flint, Florida Stormwater Association, June 12, 2014.
D - City of Austin Environmental Criteria Manual, Section 1.6.5, Texas, 2012
E - Nitrogen Transport and Transformation in Retention Basins, Marion Co, Fl, Wanielista, et al, State DEP, 2011
F - Improving Nitrogen Efficiencies in Dry Ponds, Williams and Wanielista, Florida Stormwater Association, June 16 2015

PONDS Version 3.3.0315
Retention Pond Recovery - Refined Method
Copyright 2012
Devo Seereeram, Ph.D., P.E.

Project Data

Project Name:	Murray MS
Simulation Description:	Building Pond Recovery
Project Number:	25HARV020
Engineer :	KAL
Supervising Engineer:	
Date:	02-25-2026

Aquifer Data

Base Of Aquifer Elevation, [B] (ft datum):	-2.10
Water Table Elevation, [WT] (ft datum):	7.90
Horizontal Saturated Hydraulic Conductivity, [Kh] (ft/day):	3.60
Fillable Porosity, [n] (%):	25.00
Unsaturated Vertical Infiltration Rate, [Iv] (ft/day):	3.6
Maximum Area For Unsaturated Infiltration, [Av] (ft²):	14507.0

Geometry Data

Equivalent Pond Length, [L] (ft):	485.0
Equivalent Pond Width, [W] (ft):	25.0

Ground water mound is expected to intersect the pond bottom

Stage vs Area Data

Stage (ft datum)	Area (ft²)
9.50	8600.0
10.50	12436.0
11.50	16517.0
12.50	20968.0

Discharge Structures

Discharge Structure #1 is inactive

Discharge Structure #2 is inactive

Discharge Structure #3 is inactive

HB ESTIMATING REC'D 06.01.2026

Scenario Input Data

Scenario 1 :: 17828 ft³ slug load

Hydrograph Type: Slug Load
Modflow Routing: Routed with infiltration

Treatment Volume (ft³) 17828

Initial ground water level (ft datum) 7.90 (default)

Time After Storm Event (days)	Time After Storm Event (days)
0.100	2.000
0.250	2.500
0.500	3.000
1.000	3.500
1.500	4.000

HB ESTIMATING REC'D 06.01.2026

Summary of Results *:: Scenario 1 :: 17828 ft³ slug load*

	Time (hours)	Stage (ft datum)	Rate (ft³/s)	Volume (ft³)
Stage				
Minimum	0.00	7.90		
Maximum	0.00	11.04		
Inflow				
Rate - Maximum - Positive	0.00		2971.33	
Rate - Maximum - Negative	None		None	
Cumulative Volume - Maximum Positive	0.00			17828.
Cumulative Volume - Maximum Negative	None			None
Cumulative Volume - End of Simulation	96.00			17828.
Infiltration				
Rate - Maximum - Positive	0.00		0.60	
Rate - Maximum - Negative	None		None	
Cumulative Volume - Maximum Positive	72.00			17828.
Cumulative Volume - Maximum Negative	None			None
Cumulative Volume - End of Simulation	96.00			17828.
Combined Discharge				
Rate - Maximum - Positive	None		None	
Rate - Maximum - Negative	None		None	
Cumulative Volume - Maximum Positive	None			None
Cumulative Volume - Maximum Negative	None			None
Cumulative Volume - End of Simulation	96.00			0.
Discharge Structure 1 - inactive				
Rate - Maximum - Positive	disabled		disabled	
Rate - Maximum - Negative	disabled		disabled	
Cumulative Volume - Maximum Positive	disabled			disabled
Cumulative Volume - Maximum Negative	disabled			disabled
Cumulative Volume - End of Simulation	disabled			disabled
Discharge Structure 2 - inactive				
Rate - Maximum - Positive	disabled		disabled	
Rate - Maximum - Negative	disabled		disabled	
Cumulative Volume - Maximum Positive	disabled			disabled
Cumulative Volume - Maximum Negative	disabled			disabled
Cumulative Volume - End of Simulation	disabled			disabled
Discharge Structure 3 - inactive				
Rate - Maximum - Positive	disabled		disabled	
Rate - Maximum - Negative	disabled		disabled	
Cumulative Volume - Maximum Positive	disabled			disabled
Cumulative Volume - Maximum Negative	disabled			disabled
Cumulative Volume - End of Simulation	disabled			disabled
Pollution Abatement:				
36 Hour Stage and Infiltration Volume	36.00	9.76		15436.
72 Hour Stage and Infiltration Volume	72.00	9.45		17828.

HB ESTIMATING REC'D 06.01.2026

ATTACHMENT 3

NUTRIENT LOAD REDUCTION ANALYSIS

HB ESTIMATING REC'D 06.01.2026

Complete Report (not including cost) Ver 4.3.5
Project: Murray MS
Date: 2/25/2026 1:40:01 PM
Site and Catchment Information

Analysis: Specified Removal Efficiency

Catchment Name	Basin A (Parking)	Basin E (Bldg)
Rainfall Zone	Florida Zone 5	Florida Zone 5
Annual Mean Rainfall	58.00	58.00
Pre-Condition Landuse Information		
Landuse	User Defined Values	User Defined Values
Area (acres)	1.53	8.33
Rational Coefficient (0-1)	0.55	0.14
Non DCIA Curve Number	39.00	39.00
DCIA Percent (0-100)	67.60	15.30
Nitrogen EMC (mg/l)	0.930	0.930
Phosphorus EMC (mg/l)	0.190	0.190
Runoff Volume (ac-ft/yr)	4.078	5.540
Groundwater N (kg/yr)	0.000	0.000
Groundwater P (kg/yr)	0.000	0.000
Nitrogen Loading (kg/yr)	4.676	6.352
Phosphorus Loading (kg/yr)	0.955	1.298
Post-Condition Landuse Information		
Landuse	User Defined Values	User Defined Values
Area (acres)	2.38	2.16
Rational Coefficient (0-1)	0.56	0.43
Non DCIA Curve Number	39.00	39.00
DCIA Percent (0-100)	69.00	52.70
Wet Pond Area (ac)	0.00	0.00
Nitrogen EMC (mg/l)	0.930	0.930
Phosphorus EMC (mg/l)	0.190	0.190
Runoff Volume (ac-ft/yr)	6.472	4.526
Groundwater N (kg/yr)	0.000	0.000
Groundwater P (kg/yr)	0.000	0.000
Nitrogen Loading (kg/yr)	7.421	5.190
Phosphorus Loading (kg/yr)	1.516	1.060

Catchment Number: 1 Name: Basin A (Parking)
Project: Murray MS
Date: 2/25/2026

Rain Garden detention with media Design

Type of System	**Detention**
Type of Media Mix	**IFGEM**
Sustainable Void Fraction (0-1)	**0.300**
Media Volume (Cubic Feet)	**12,326.000**
Water Storage Above Media (cubic feet)	**11,983.000**
Provided retention volume for efficiency (ac-ft)	**0.360**
Provided Media Treatment Depth (in)	**1.815**
Minimum Media Area (SF)	**407.717**
Media Area (SF)	**6,163.000**

Watershed Characteristics

Catchment Area (acres)	**2.38**
Contributing Area (acres)	**2.380**
Non-DCIA Curve Number	**39.00**
DCIA Percent	**69.00**
Rainfall Zone	**Florida Zone 5**
Rainfall (in)	**58.00**

Surface Water Discharge

Required TN Treatment Efficiency (%)	**80**
Provided TN Treatment Efficiency (%)	**70**
Required TP Treatment Efficiency (%)	**80**
Provided TP Treatment Efficiency (%)	**84**

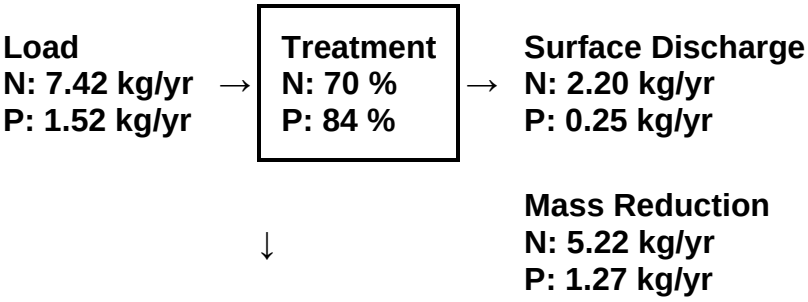
Media Mix Information

Type of Media Mix	**IFGEM**
Media N Reduction (%)	**80**
Media P Reduction (%)	**95**

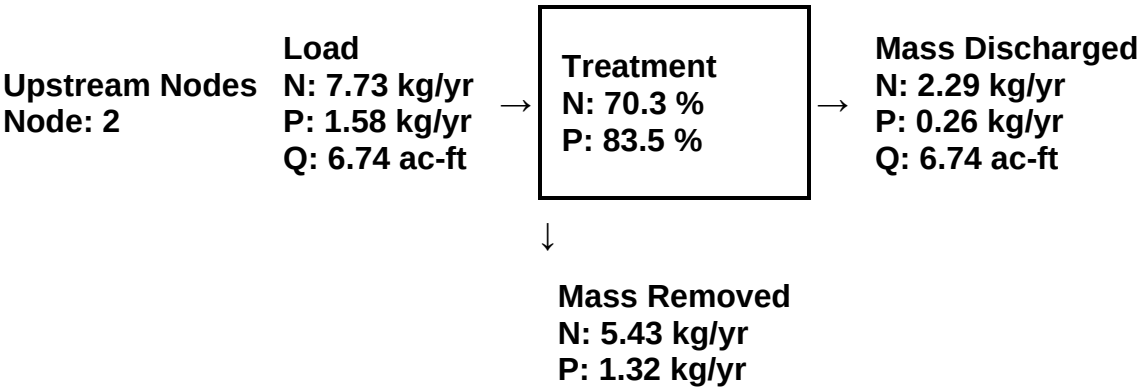
Groundwater Discharge (Stand-Alone)

Treatment Rate (MG/yr)	**1.854**
TN Mass Load (kg/yr)	**1.305**
TN Concentration (mg/L)	**0.186**
TP Mass Load (kg/yr)	**0.067**
TP Concentration (mg/L)	**0.010**

Load Diagram for Rain Garden detention with media (stand-alone)



Load Diagram for Rain Garden (As Used In Routing)



Catchment Number: 2 Name: Basin E (Bldg)
Project: Murray MS
Date: 2/25/2026

Retention Design

Retention Depth (in)	**2.273**
Retention Volume (ac-ft)	**0.409**

Watershed Characteristics

Catchment Area (acres)	**2.16**
Contributing Area (acres)	**2.160**
Non-DCIA Curve Number	**39.00**
DCIA Percent	**52.70**
Rainfall Zone	**Florida Zone 5**
Rainfall (in)	**58.00**

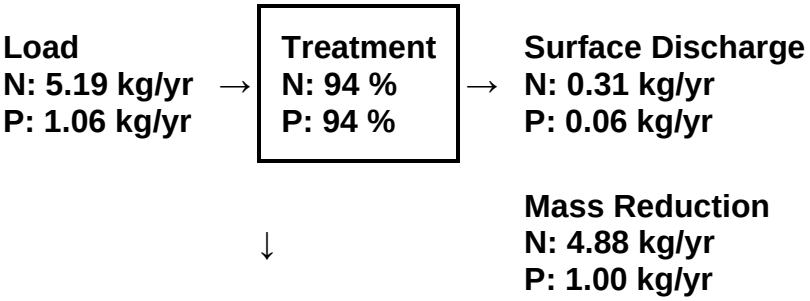
Surface Water Discharge
Required TN Treatment Efficiency (%) 80

Provided TN Treatment Efficiency (%) 94
Required TP Treatment Efficiency (%) 80
Provided TP Treatment Efficiency (%) 94

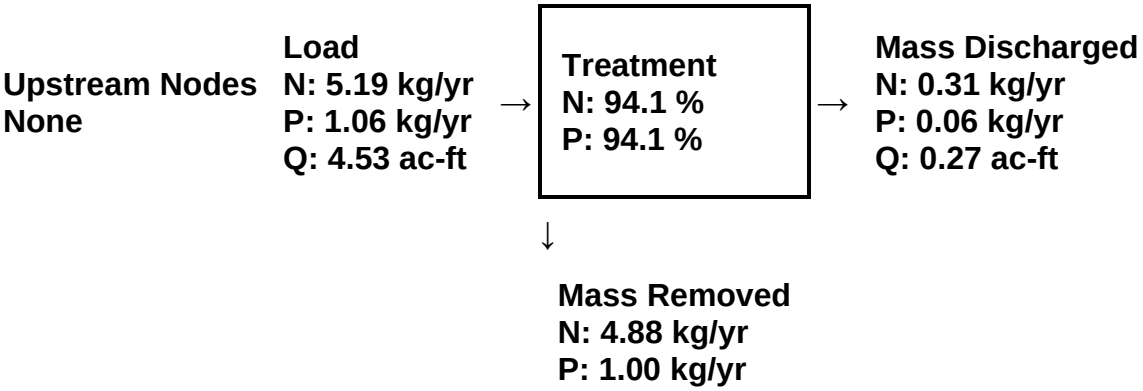
Media Mix Information
Type of Media Mix Not Specified
Media N Reduction (%)
Media P Reduction (%)

Groundwater Discharge (Stand-Alone)
Treatment Rate (MG/yr) 0.000
TN Mass Load (kg/yr) 4.884
TN Concentration (mg/L) 0.000
TP Mass Load (kg/yr) 0.998
TP Concentration (mg/L) 0.000

Load Diagram for Retention (stand-alone)



Load Diagram for Retention (As Used In Routing)



Summary Treatment Report Version: 4.3.5
Project: Murray MS

Analysis Type: Specified Removal Efficiency **Date:2/25/2026**

BMP Types:

Catchment 1 - (Basin A (Parking)) Rain Garden detention with media

Catchment 2 - (Basin E (Bldg)) Retention

Routing Summary
Catchment 1 Routed to Outlet
Catchment 2 Routed to Catchment 1

Based on % removal values to the nearest percent

Total nitrogen target removal met? Yes
Total phosphorus target removal met? Yes

Summary Report

Nitrogen

Surface Water Discharge		
Total N pre load	**11.03 kg/yr**	
Total N post load	**12.61 kg/yr**	
Target N load reduction	**80 %**	
Target N discharge load	**2.52 kg/yr**	
Percent N load reduction	**82 %**	
Provided N discharge load	**2.29 kg/yr**	**5.06 lb/yr**
Provided N load removed	**10.32 kg/yr**	**22.75 lb/yr**

Phosphorus

Surface Water Discharge		
Total P pre load	**2.253 kg/yr**	
Total P post load	**2.577 kg/yr**	
Target P load reduction	**80 %**	
Target P discharge load	**.515 kg/yr**	
Percent P load reduction	**90 %**	
Provided P discharge load	**.26 kg/yr**	**.57 lb/yr**
Provided P load removed	**2.316 kg/yr**	**5.107 lb/yr**

HB ESTIMATING REC'D 06.01.2026

Appendix M

Rainfall Criteria

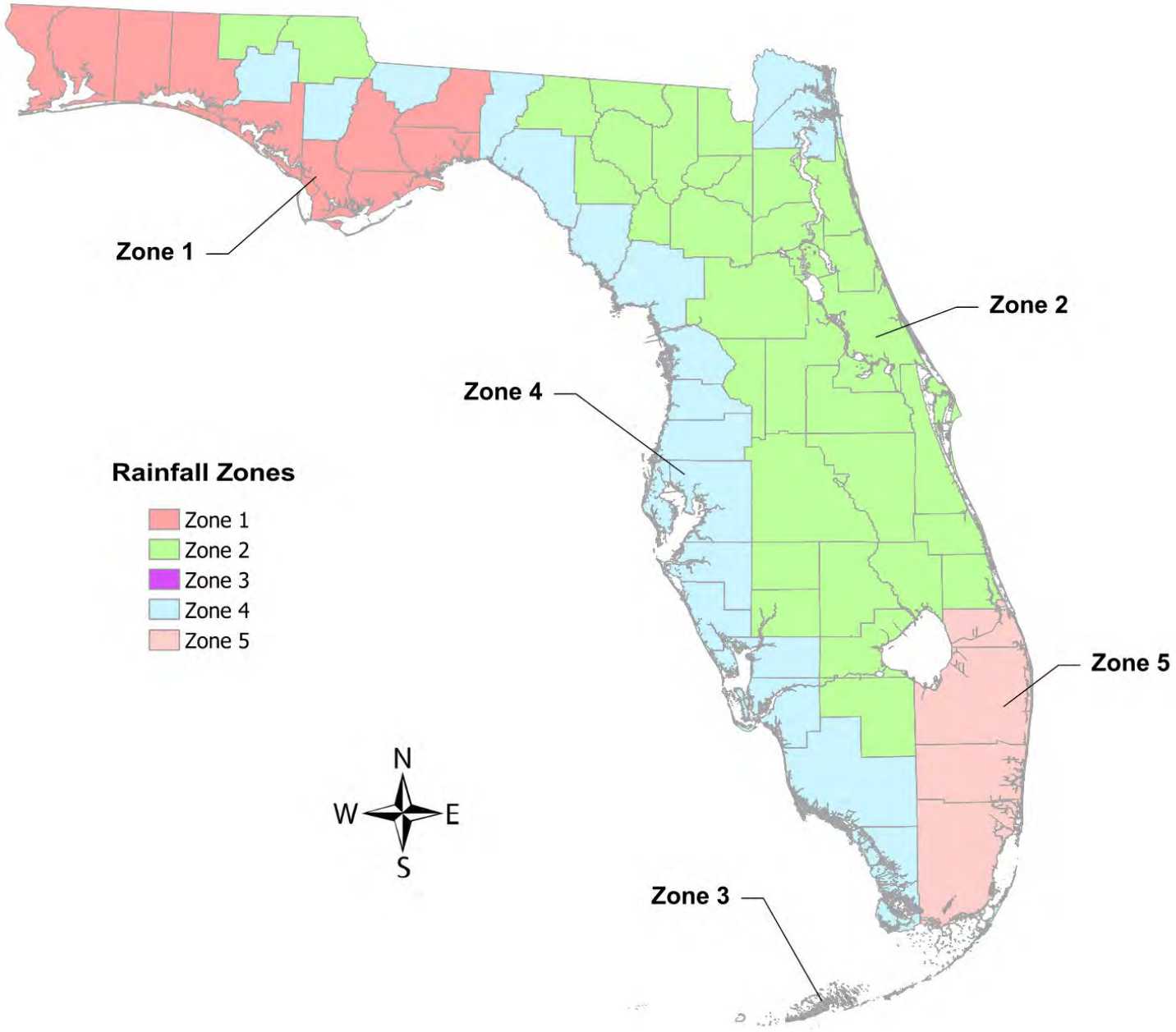
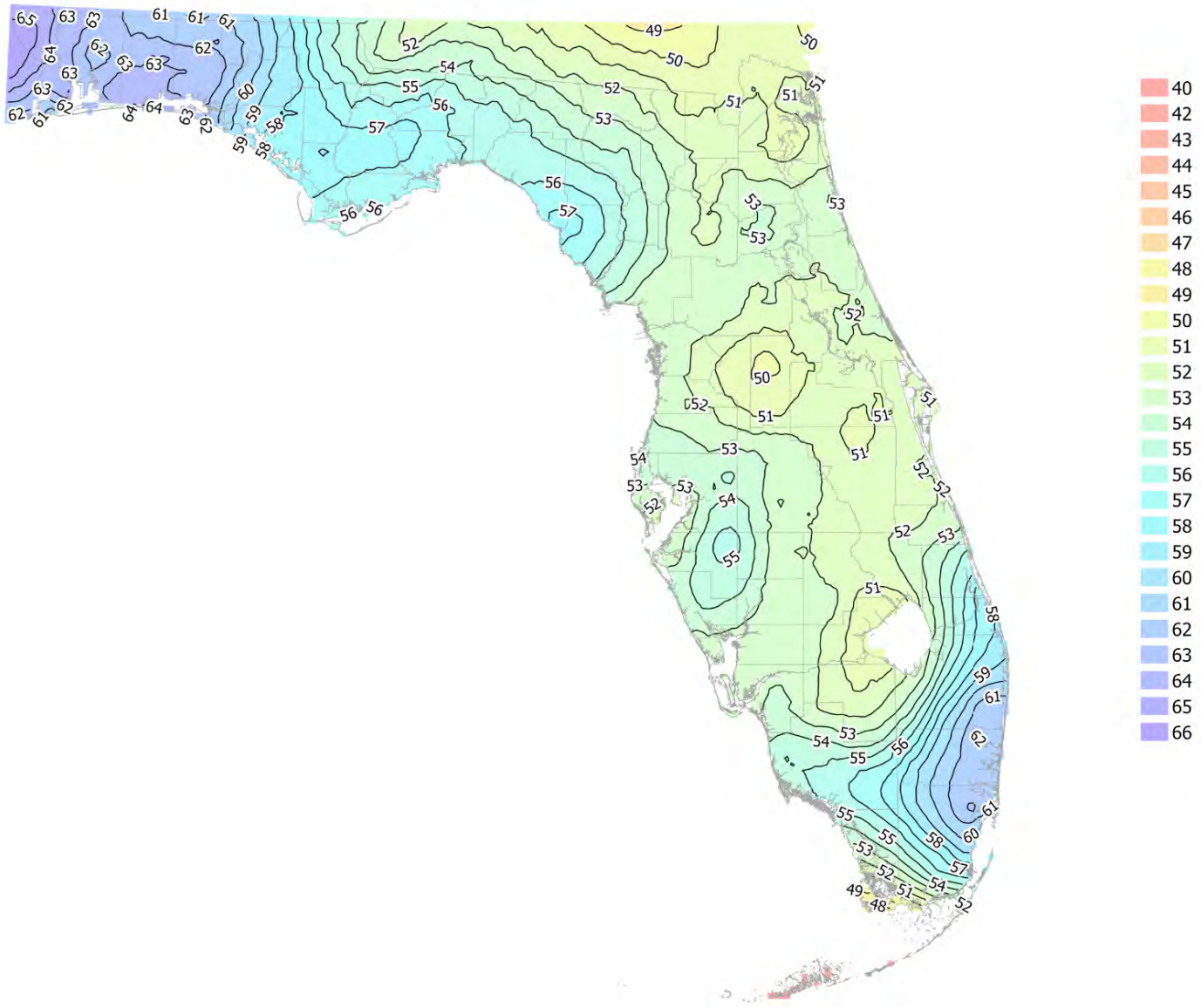


Figure 1: Designated Meteorological Regions (Zones) in Florida

Table 1: Counties Included in the Designated Meteorological Zones

ZONE 1	ZONE 2	ZONE 3	ZONE 4	ZONE 5
Bay	Alachua	Monroe County - Florida Keys from Key Largo to Key West	Charlotte	Broward
Escambia	Baker		Citrus	Miami-Dade
Franklin	Bradford		Collier	Martin
Gulf	Brevard		Dixie	Palm Beach
Leon	Calhoun		Duval	
Liberty	Clay		Hernando	
Okaloosa	Columbia		Hillsborough	
Santa Rosa	Desoto		Jefferson	
Wakulla	Flagler		Lee	
Walton	Gadsden		Levy	
	Gilchrist		Manatee	
	Glades		Mainland	
	Hamilton		Monroe	
	Hardee		Nassau	
	Hendry		Pasco	
	Highlands		Pinellas	
	Holmes		Sarasota	
	Indian River		Taylor	
	Jackson		Washington	
	Lafayette			
	Lake			
	Madison			
	Marion			
	Okeechobee			
	Orange			
	Osceola			
	Polk			
	Putnam			
	Seminole			
	St. Johns			
	St. Lucie			
	Sumter			
	Suwannee			
	Union			
	Volusia			

Figure 2: Average Annual Rainfall Isopleth Map for Florida



9.2.2 Calculating Predevelopment and Post-development Stormwater Nutrient Loading

a. To calculate the predevelopment and post development loadings before treatment of the annual mass loadings for TN and TP, multiply the predevelopment annual runoff volume (derived in Section 9.2.1) by the land use specific runoff characterization data (event mean concentrations or EMCs) for TN and TP. Applicants must use the most up-to-date verified EMC values, where available and incorporated by reference pursuant to rule 62.330.301(4), for their project region. Applicants also must comply with the applicable special basin or geographic area criteria in rule 62-330.301(1)(k), F.A.C., including any EMC values specified in the applicable Applicant's Handbook Volume II. EMC Values are listed in Table 9.2 for different types of land use categories. EMC values for the land uses must consider cover, soils, and topography and be representative of the latest assigned Florida Land Use and Cover Classification System (FLUCCS) code.

Table 9.2 Standardized Statewide Stormwater Nutrient EMC Values

Land Use Category	Total N (mg/l)	Total P (mg/l)
Low Density Residential	1.65	0.270
Single Family	1.77	0.327
Multi-Family	1.84	0.520
Low Intensity Commercial	0.93	0.19
High Intensity Commercial	2.40	0.345
Light Industrial	1.20	0.260
Highway	1.25	0.173
Dry Prairie	2.025	0.184
Marl Prairie	0.684	0.012
Mesic Flatwoods	1.087	0.043
Ruderal/Upland Pine	1.694	0.162
Scrubby Flatwoods	1.155	0.027
Upland Hardwood	1.042	0.346
Upland Mixed Forest	0.606	1.166
Wet Flatwoods	1.213	0.021
Wet Prairie	1.095	0.015
Xeric Scrub	1.596	0.156
Rangeland/parkland	1.150	0.055
General Agricultural	2.29	0.381
Pasture	3.03	0.593
Citrus	2.11	0.180
Row Crops	2.50	0.577

b. At the time of the application, an applicant may propose to use TN and TP EMC values accepted by the Agency which denote EMC values derived from regional or local government studies. Any study conducted must be submitted with the permit application for the Agency records. If EMC values from a study are to be used, data collected must follow quality assurance provisions outlined in chapter 62-160, F.A.C., and include:
   - Data collected at a representative variety of rainfall depths;
   - Minimum of 10 rainfall events;
   - Minimum of one year of data with seasonal variation;
   - Use of autosamplers to allow for runoff to be sampled for the duration of the rainfall event;
   - Volume or time weighted composite samples;

Appendix A – Media Mixes Datasheet

Media[1]	Minimum	Treatment[2]	Treatment Efficiency[3]		Sustain	OP Removal[5]	Density[6]
	Depth (in)	Rate (GPM/SF)	TN (%)	TP(%)	Void %[4]	Rate (mg/g)	Lbs/CF
B&G ECT3 or ECT	24	1	45/25[7]	45/25[7]	30	0.2	43
IFGEM	24	0.104	80	95	30	0.6	105
User Defined	24						
B&G CTS12	12	0.052	60	90	30	0.2	95
B&G CTS24	24	0.052	75	95	30	0.2	95
Per Pave[8]	3	0.052	60	90	30	0.2	95
SAT[9]	24	0.02	20	45	30	0	100

1. June 2022 commonly used. Others can be included as user defined.
2. Treatment Rate including a factor of safety=2
3. Average annual concentration reduction;
   mass reduction is the product of concentration and water passing through filter.
4. Percent of water in the media after loading with stormwater equal to 10 years of operation.
5. Measured dissolved fraction usually as Ortho-Phosphate (OP) in (mg OP/g of media).
6. Dry densities at operating density, will vary with source materials.
7. 45/25 (stand-alone BMP/downstream of another BMP) average annual efficiencies.
8. Limited to the bottom of at least a 12 inch deep pervious pavement reservoir.
9. Limited to a stand-alone BMP or first in a series of BMPs, reflecting particulate removal.

Notes: 1. Average annual concentration reduction values are for a 50% mix of particulates.

2. Efficiencies are for stormwater runoff events with dry periods (no rainfall).
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4. Species mix for TN has DON less than 20% of the TN.

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F - Improving Nitrogen Efficiencies in Dry Ponds, Williams and Wanielista, Florida Stormwater Association, June 18 2015

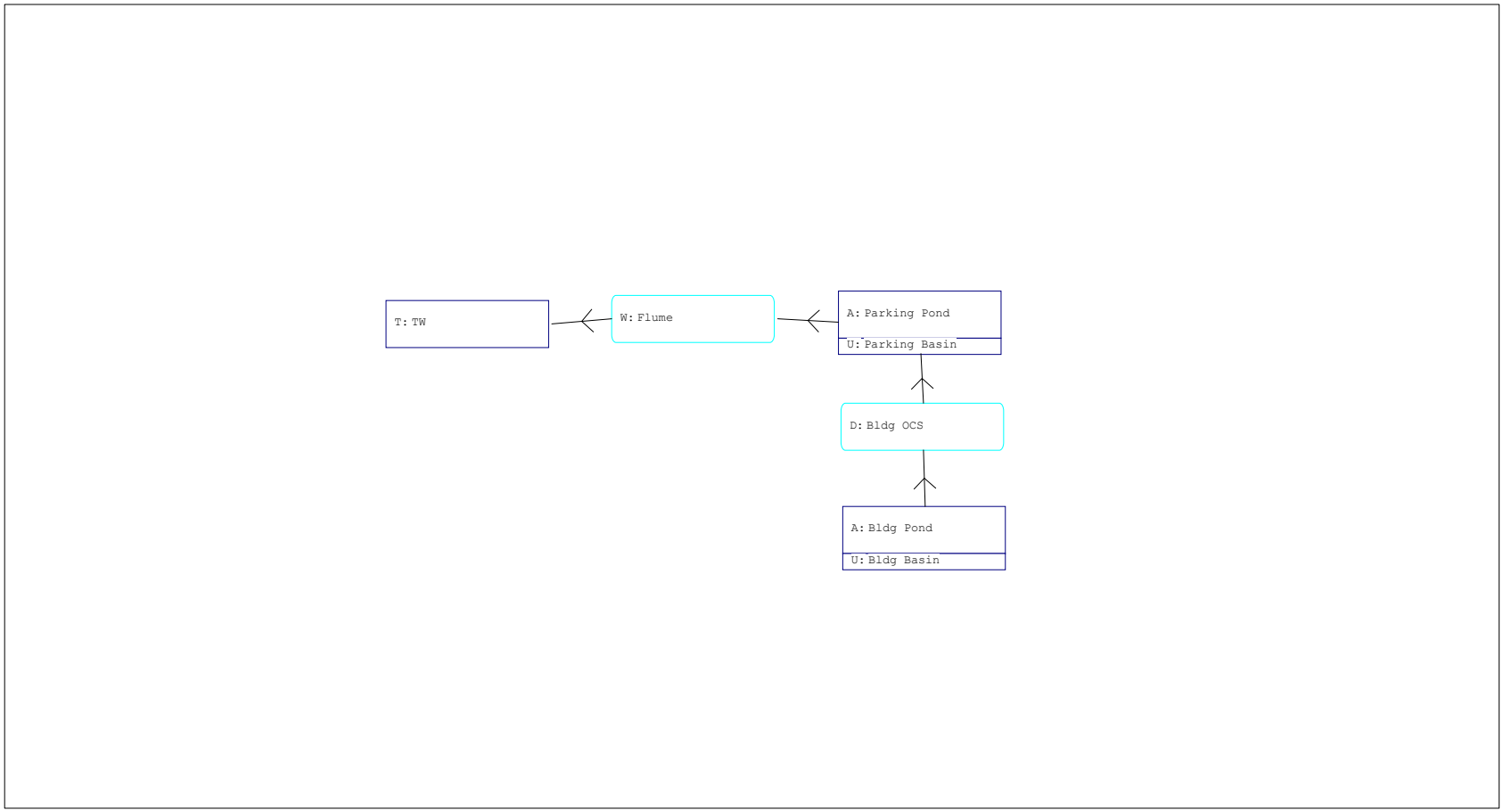
ATTACHMENT 4

ICPR ROUTING ANALYSES

Nodes
A Stage/Area
V Stage/Volume
T Time/Stage
M Manhole

Basins
O Overland Flow
U SCS Unit CN
S SBUH CN
Y SCS Unit GA
Z SBUH GA

Links
P Pipe
W Weir
C Channel
D Drop Structure
B Bridge
R Rating Curve
H Breach
E Percolation
F Filter
X Exfil Trench



Name	Simulation	Max Stage ft	Warning Stage ft	Max Delta Stage ft	Max Surf Area ft2	Max Inflow cfs	Max Outflow cfs
Bldg Pond	10072	12.59	12.75	0.0050	25706	16.47	4.56
Parking Pond	10072	11.27	11.50	0.0038	6525	18.47	18.31
TW	10072	10.50	11.00	0.0003	0	18.31	0.00
Bldg Pond	1024	11.72	12.75	0.0050	17465	9.80	2.94
Parking Pond	1024	11.18	11.50	0.0050	6408	10.35	10.27
TW	1024	10.50	11.00	0.0003	0	10.27	0.00
Bldg Pond	2572	12.36	12.75	-0.0050	20316	14.01	4.18
Parking Pond	2572	11.24	11.50	0.0035	6491	15.97	15.82
TW	2572	10.50	11.00	0.0003	0	15.82	0.00

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==========
==== Basins ====
==========

Name: Bldg Basin Node: Bldg Pond Status: Onsite
Group: BASE Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh323 Peaking Factor: 323.0
Rainfall File: Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000 Time of Conc(min): 10.00
Area(ac): 2.530 Time Shift(hrs): 0.00
Curve Number: 80.00 Max Allowable Q(cfs): 999999.000
DCIA(%): 47.00

Name: Parking Basin Node: Parking Pond Status: Onsite
Group: BASE Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh323 Peaking Factor: 323.0
Rainfall File: Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000 Time of Conc(min): 10.00
Area(ac): 2.260 Time Shift(hrs): 0.00
Curve Number: 80.00 Max Allowable Q(cfs): 999999.000
DCIA(%): 59.00

==========
==== Nodes ====
==========

Name: Bldg Pond Base Flow(cfs): 0.000 Init Stage(ft): 9.500
Group: BASE Warn Stage(ft): 12.750
Type: Stage/Area

Stage(ft)	Area(ac)
9.500	0.1970
10.500	0.2850
11.500	0.3790
12.500	0.4810
12.750	0.7750

Name: Parking Pond Base Flow(cfs): 0.000 Init Stage(ft): 8.500
Group: BASE Warn Stage(ft): 11.500
Type: Stage/Area

Stage(ft)	Area(ac)
8.500	0.0630
11.500	0.1570

Name: TW Base Flow(cfs): 0.000 Init Stage(ft): 10.000
Group: BASE Warn Stage(ft): 11.000
Type: Time/Stage

Time(hrs)	Stage(ft)
0.00	10.000
24.00	10.500
48.00	10.500
72.00	10.000

==========
==== Drop Structures ====
==========

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```
        Name: Bldg OCS            From Node: Bldg Pond          Length(ft): 272.00
       Group: BASE                  To Node: Parking Pond           Count: 1

              UPSTREAM       DOWNSTREAM                 Friction Equation: Automatic
    Geometry: Circular       Circular                 Solution Algorithm: Most Restrictive
    Span(in): 15.00          15.00                                 Flow: Both
    Rise(in): 15.00          15.00                    Entrance Loss Coef: 0.000
  Invert(ft): 9.000          8.500                        Exit Loss Coef: 1.000
 Manning's N: 0.012000       0.012000                   Outlet Ctrl Spec: Use dc or tw
Top Clip(in): 0.000          0.000                       Inlet Ctrl Spec: Use dc
Bot Clip(in): 0.000          0.000                          Solution Incs: 10

Upstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall



*** Weir 1 of 1 for Drop Structure Bldg OCS ***
                                                                                TABLE
                 Count: 1                      Bottom Clip(in): 0.000
                  Type: Horizontal                Top Clip(in): 0.000
                  Flow: Both                   Weir Disc Coef: 3.200
              Geometry: Rectangular           Orifice Disc Coef: 0.600

              Span(in): 37.00                       Invert(ft): 11.000
              Rise(in): 24.00                  Control Elev(ft): 11.000


================================================================================
==== Weirs =====================================================================
================================================================================

        Name: Flume               From Node: Parking Pond
       Group: BASE                  To Node: TW
        Flow: Both                    Count: 1
        Type: Vertical: Mavis      Geometry: Trapezoidal

           Bottom Width(ft): 40.00
       Left Side Slope(h/v): 4.00
      Right Side Slope(h/v): 4.00
                  Invert(ft): 11.000
     Control Elevation(ft): 11.000
    Struct Opening Dim(ft): 9999.00
                                        TABLE
            Bottom Clip(ft): 0.000
               Top Clip(ft): 0.000
          Weir Discharge Coef: 3.200
    Orifice Discharge Coef: 0.600



================================================================================
==== Hydrology Simulations =====================================================
================================================================================

        Name: 10072
    Filename: O:\Land Projects 2025\25HARV020 - Murray MS Additions\SFWMD\Modeling\ICPR\10072.R32

     Override Defaults: Yes
   Storm Duration(hrs): 72.00
         Rainfall File: Sfwmd72
   Rainfall Amount(in): 14.00

Time(hrs)       Print Inc(min)
--------------- ---------------
80.000          5.00

--------------------------------------------------------------------------------------------------------
        Name: 1024
    Filename: O:\Land Projects 2025\25HARV020 - Murray MS Additions\SFWMD\Modeling\ICPR\1024.R32

     Override Defaults: Yes
   Storm Duration(hrs): 24.00
         Rainfall File: Flmod
   Rainfall Amount(in): 6.80
```


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```
Time(hrs)       Print Inc(min)
--------------- ---------------
30.000          5.00

-------------------------------------------------------------------------------------------------
         Name: 2572
     Filename: O:\Land Projects 2025\25HARV020 - Murray MS Additions\SFWMD\Modeling\ICPR\2572.R32

      Override Defaults: Yes
    Storm Duration(hrs): 72.00
          Rainfall File: Sfwmd72
    Rainfall Amount(in): 12.00

Time(hrs)       Print Inc(min)
--------------- ---------------
80.000          5.00

=================================================================================================
==== Routing Simulations ========================================================================
=================================================================================================

         Name: 10072               Hydrology Sim: 10072
     Filename: O:\Land Projects 2025\25HARV020 - Murray MS Additions\SFWMD\Modeling\ICPR\10072.I32

      Execute: Yes         Restart: No            Patch: No
  Alternative: No

        Max Delta Z(ft): 1.00                    Delta Z Factor: 0.00500
    Time Step Optimizer: 10.000
        Start Time(hrs): 0.000                    End Time(hrs): 80.00
     Min Calc Time(sec): 0.5000              Max Calc Time(sec): 60.0000
        Boundary Stages:                         Boundary Flows:



Time(hrs)       Print Inc(min)
--------------- ---------------
999.000         15.000

Group           Run
--------------- -----
BASE            Yes


-------------------------------------------------------------------------------------------------
         Name: 1024                Hydrology Sim: 1024
     Filename: O:\Land Projects 2025\25HARV020 - Murray MS Additions\SFWMD\Modeling\ICPR\1024.I32

      Execute: Yes         Restart: No            Patch: No
  Alternative: No

        Max Delta Z(ft): 1.00                    Delta Z Factor: 0.00500
    Time Step Optimizer: 10.000
        Start Time(hrs): 0.000                    End Time(hrs): 30.00
     Min Calc Time(sec): 0.5000              Max Calc Time(sec): 60.0000
        Boundary Stages:                         Boundary Flows:



Time(hrs)       Print Inc(min)
--------------- ---------------
999.000         15.000

Group           Run
--------------- -----
BASE            Yes


-------------------------------------------------------------------------------------------------
         Name: 2572                Hydrology Sim: 2572
     Filename: O:\Land Projects 2025\25HARV020 - Murray MS Additions\SFWMD\Modeling\ICPR\2572.I32

      Execute: Yes         Restart: No            Patch: No
  Alternative: No

        Max Delta Z(ft): 1.00                    Delta Z Factor: 0.00500
    Time Step Optimizer: 10.000
```


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Start Time(hrs): 0.000 End Time(hrs): 80.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

Time(hrs)	Print Inc(min)
999.000	15.000

Group	Run
BASE	Yes

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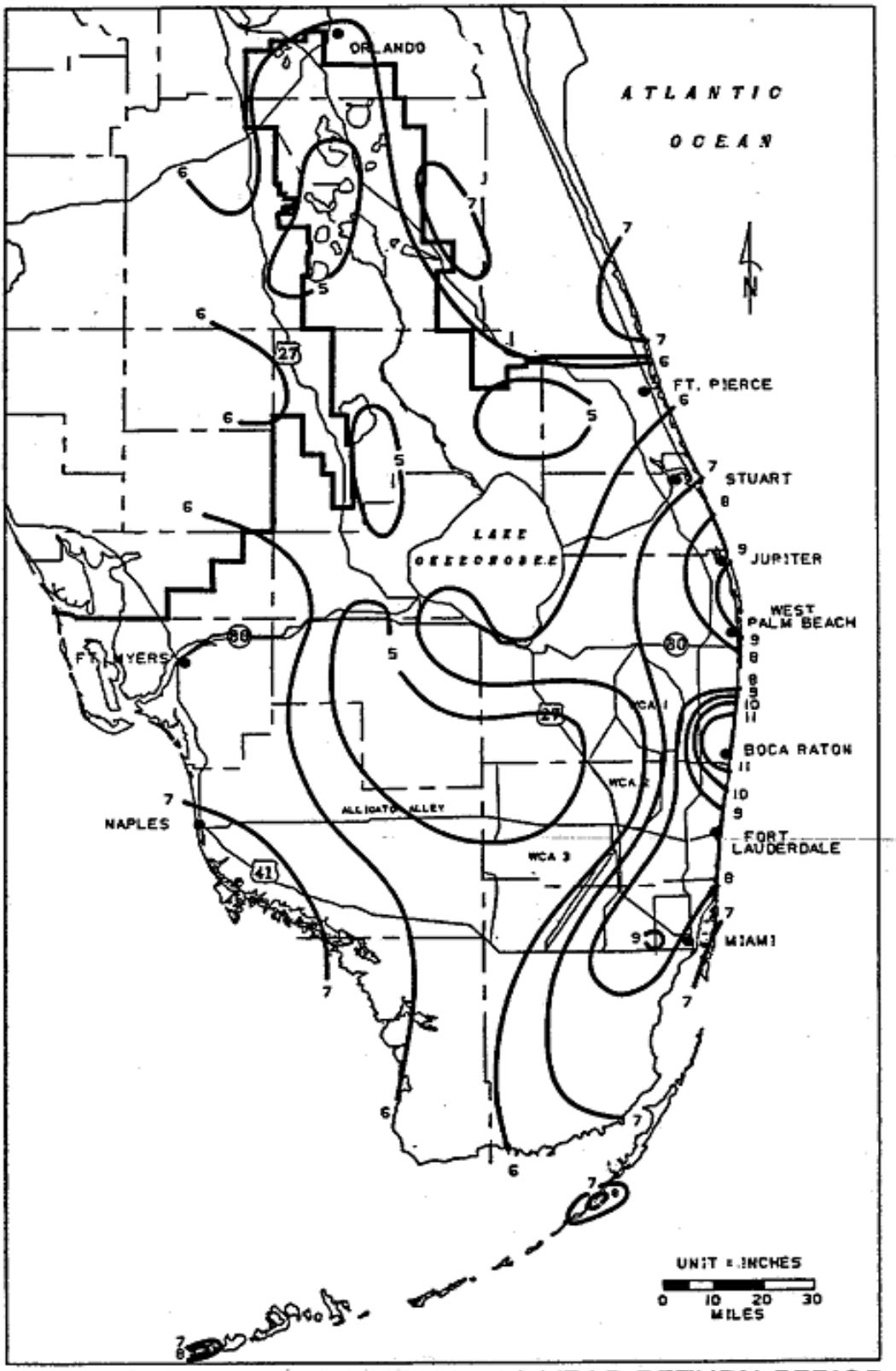


FIGURE C-4. 1-DAY RAINFALL: 10-YEAR RETURN PERIOD

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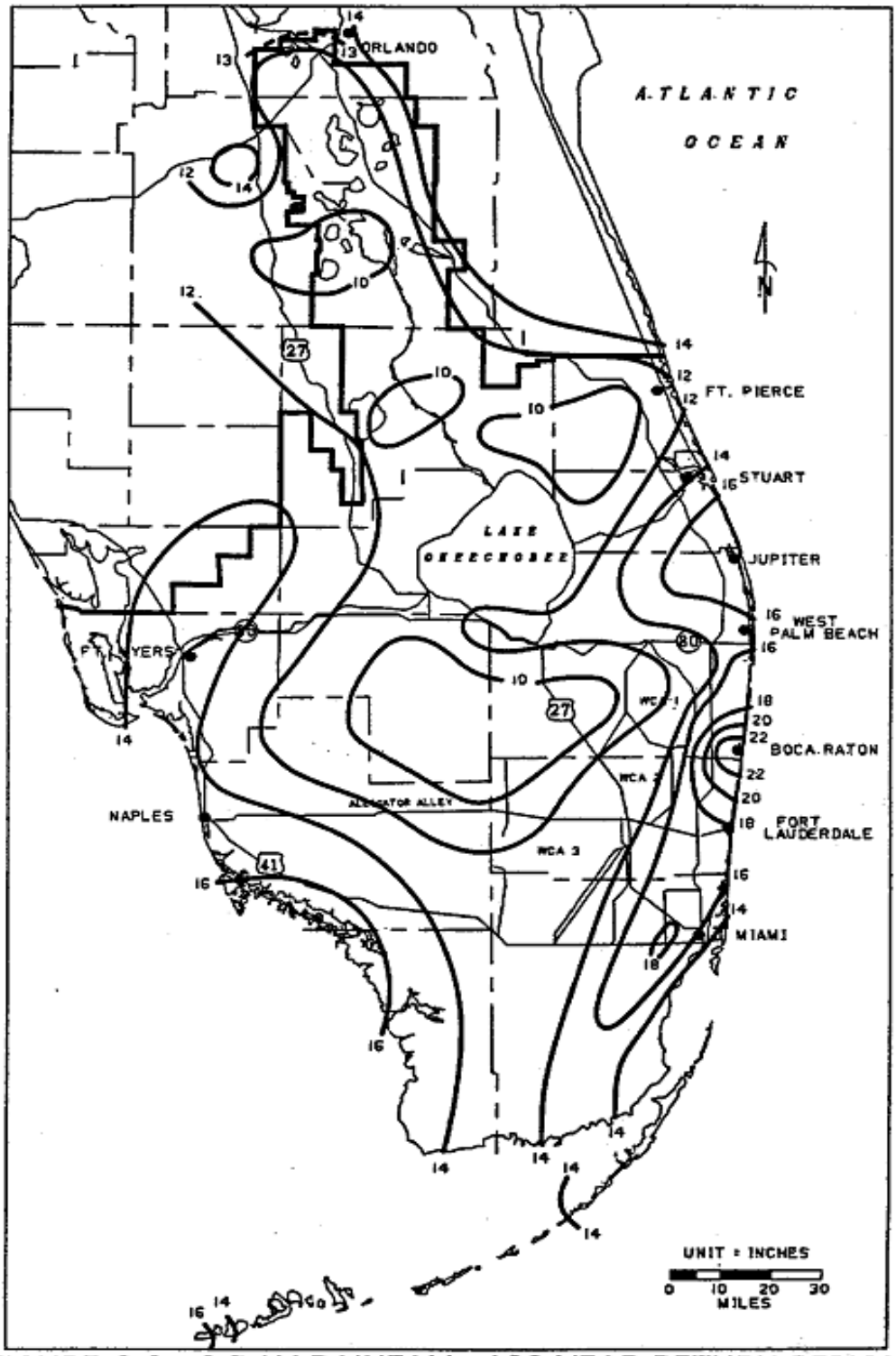


FIGURE C-9. 3-DAY RAINFALL: 100-YEAR RETURN PERIOD

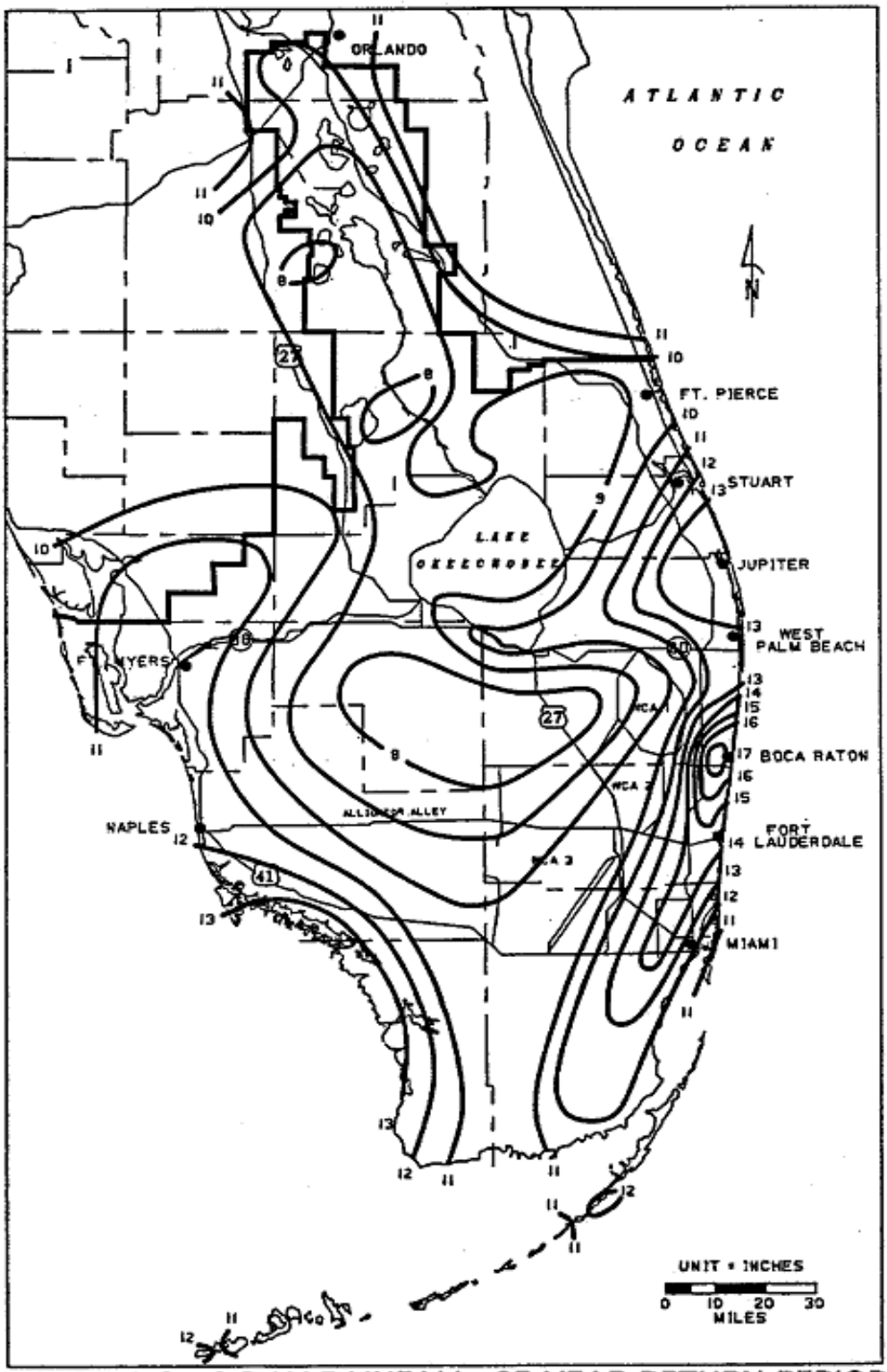


FIGURE C-8. 3-DAY RAINFALL: 25-YEAR RETURN PERIOD

SECTION 00 31 32.0 - GEOTECHNICAL DATA

PART 1 GENERAL

1.1 GEOTECHNICAL DATA

A. This document provides Owner's information for Bidders' convenience and is not meant to supplement the Bidders' own investigations. The attachment is made available for Bidders' information only.

B. The subsurface soil investigation is to determine the nature of the soil below the natural grade has been made at various locations on the site. Test borings indicate only the soil conditions at the points where samples were taken and are not intended to indicate the soil conditions for the entire site.

C. The complete soil investigation data report, "Report of Geotechnical Engineering Services," dated February 18, 2026, is made available for the convenience of the Contractor only and is included herewith as follows:

1. Report of the Geotechnical Investigation prepared by:

Pacifica Engineering Services, LLC. (PACIFICA)
601 North Congress Avenue, Suite 303
Delray Beach, Florida 33445
(561) 419-8460

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

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February 18, 2026

Hedrick Brothers
2200 Centrepark West Drive
West Palm Beach, Florida 33409

Attention: Mr. Ben Coats
Email: bcoats@hedrickbrothers.com
Phone: (561) 943-6222

Re: Report of Geotechnical Engineering Services
Martin County School District (MCSD) Murray Middle School Modernization
4400 SE Murray Street
Stuart, Florida 34997
PACIFICA Project No.: 320-26632

Dear Mr. Goats,

Pacifica Engineering Services, LLC. (PACIFICA) has completed geotechnical engineering study for the above-referenced project. The scope of geotechnical services was completed in general accordance with PACIFICA Proposal for Geotechnical Engineering Services Number 610-120114727 dated January 8, 2026. Authorization to proceed was provided via signed proposal on January 12, 2026.

PACIFICA appreciates the opportunity to provide geotechnical engineering services on this project and looks forward to an opportunity to participate in construction-related aspects of the development. If you have any questions or should additional information, be required, please do not hesitate to contact our office at (561) 491-8460.

Sincerely,

Pacifica Engineering Services
Florida Certification of Authorization License No. 32328

Kimberly Narvaez Ceballos
Staff Engineer

Andre Kniazeff

ANDRE KNIAZEFF LICENSE No 81315 STATE OF FLORIDA PROFESSIONAL ENGINEER

Andre Kniazeff, P.E.
Chief Geotechnical Engineer
FL License No. 81315

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Sheet 2: Boring Location Plan – Aerial
Sheet 3: Boring Location Plan – Site
Boring Logs
Percolation Test Result
Laboratory Test Results
GPR Scanning Results

1.0 GENERAL PROJECT INFORMATION

The project site is located at 4400 SE Murray Street in Stuart, Florida. A site vicinity map that shows the general location of the project site is located on Sheet 1 of the Appendix. The site is developed with the existing school facility.

The project consists of the design and construction of a new two-story building addition with associated stormwater management system (SMS) and paved areas. Maximum column and wall foundation loads, reportedly, will be on the order of 180 kips and 4½ kips/ft, respectively. Similarly, site grading information was not provided and the assumption that final site grades will match existing grades has been made.

If any of the information in this report is incorrect or has changed, please notify PACIFICA so that the recommendations presented within may be checked. PACIFICA will not be held responsible if not given the opportunity to check the recommendations once designs have been completed.

2.0 FIELD EXPLORATION

2.1 Ground Penetrating Radar (GPR) Scanning

PACIFICA performed GPR scanning at each borehole location to ensure that there were no underground utilities present in the boring location prior to drilling. We used the following equipment for this project:

LEICA DSX Utility Scan: An underground GPR antenna that operates with frequencies ranging from 400 MHz to 600 MHz and is mounted in a stroller frame that rolls over the surface. Data is displayed on a screen and marked in the field in real-time. The surface needs to be reasonably smooth and unobstructed to obtain readable scans. Obstructions such as curbs, landscaping, and vegetation will limit the efficacy of GPR. The total effective scan depth can be as much as 15 feet or more with this antenna but can vary widely depending on the soil conditions and composition.

The presence of clay, or a shallow water table, may limit maximum scanning depths to 3 feet or less. As depth increases, targets must be larger to be detected, and non-metallic targets can be challenging to locate. The depths provided should always be treated as estimates as their accuracy can be affected by multiple factors.

LEICA DD100 Utility Locator: A radio-detection precision locator which detects electromagnetic fields. This device is used to actively trace conductive pipes and tracer wires or passively detect power and radio signals traveling along conductive pipes and utilities.

2.2 Geotechnical Borings

Eighteen (18) Standard Penetration Test (SPT) geotechnical borings were performed to assess the subsurface conditions at the requested locations. The following borings were completed:

- Nine (9) SPT borings, each to a depth of 35 feet below existing grades (beg), within the proposed structure footprint.
- Nine (9) SPT boring, each to a depth of 15 feet beg, within the proposed SMS and pavement areas.

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Boring location plans can be found on Sheets 2 and 3 of the Appendix.

The SPT borings were performed using a CME-55 truck-mounted and a 7822DT track-mounted geotechnical drilling rig equipped with an automatic hammer utilizing mud rotary drilling techniques. The SPT samples were collected continuously in the upper 10 feet and at 5-foot intervals thereafter until final boring depths were reached.

After the samples were collected in the split barrel sampler they were bagged, labeled, and transported back to the laboratory for description and limited testing. After the geotechnical borings were completed, they were backfilled using access auger cuttings and the ground surface was generally leveled.

2.3 Subsurface Conditions

In general, the soil profile consisted of loose to very dense sands to slightly silty sands (SP and SP-SM, respectively) extending from the existing ground surface to the maximum depth explored of 35 feet beg.

The individual boring logs included in the Appendix show the various soil types and stratifications. The transition between soil stratums may be gradual and not as definitive as it appears on the boring logs. If the contractor cannot determine the soil stratum during construction the geotechnical engineer should be consulted.

2.4 Groundwater and Seasonal High Ground Water Table (SHGWT)

Groundwater was encountered at depths varying from 4 feet to 7 feet beg (with the differences in the depths to groundwater being attributed primarily to the differences in ground surface elevations at which the borings were drilled) at the time of our subsurface exploration. Based on our review of the subsurface conditions encountered in the test borings, it appears that the normal permanent seasonal high groundwater (SHGW) table will occur within ±3 feet above the groundwater levels measured at each boring location during our field exploration.

In general, the estimated normal seasonal high groundwater level is not intended to define a limit or ensure that future seasonal fluctuations in groundwater levels will not exceed the estimated levels. Groundwater conditions will vary with environmental changes and seasonal conditions, such as, the frequency and magnitude of rainfall patterns, as well as man-made influences, such as swales, drainage ponds, underdrains, stormwater collection systems and areas of covered soil (buildings, paved parking lots, sidewalks, etc.). We recommend that the Contractor determine the actual groundwater level at the site at the time of the construction activities.

2.5 Percolation Test

Four (4) percolation tests were performed at boring locations B-4 and B-11 at a depth of 10 feet beg. The percolation test was performed in general accordance with the South Florida Water Management District (SFWMD) procedures for the “Usual Condition Constant Head” Percolation Test. The borehole was advanced using a 3-inch diameter casing. A 2-inch diameter perforated PVC pipe was placed in the boreholes prior to retrieving the casing. Water was then pumped into the borehole in order to raise the water level as close to the ground surface as possible. Once the inflow equalized with the outflow rate, the average pumping rate and level of the water for this stabilized flow rate was recorded. The results of the percolation test are included in the Appendix section of this report.

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Table 1 below shows the condensed results, the full results located in the Appendix should be used when the exfiltration trenches are being designed. It should be noted that the designer should apply an appropriate factor of safety to the reported values.

TABLE 1: PERCOLATION TEST RESULTS

Boring ID	Date	Depth of Test (ft)	Depth of Groundwater Prior to Test (ft)	Average Flow Rate (GPM)	K, Hydraulic Conductivity (CFS/ft²-ft)
B-1	01/27/26	10	7	0.9	8.4E-05
B-3	01/27/26	10	6	0.8	8.1E-05
B-4	01/27/26	10	6	0.9	9.1E-05
B-8	01/29/26	10	7	0.9	8.4E-05

3.0 GEOTECHNICAL LABORATORY TESTING

The soil samples collected from the geotechnical borings were taken back to the laboratory and visually reviewed by a geotechnical engineer. The soil samples were classified using the Unified Soil Classification System (USCS) in general accordance with the American Society of Testing and Materials (ASTM) test designation D2487. Laboratory tests for natural water content (ASTM D2216), percent passing the No. 200 sieve (ASTM D1140), and organic content (ASTM D2974) were performed on selected samples retrieved during the field exploration from soil borings to verify the visual and tactile soil classifications. Laboratory test results are included in the Appendix.

4.0 FOUNDATION RECOMMENDATIONS

4.1 Geotechnical Discussion

Loose soil conditions were encountered in most of the test borings performed within the proposed structure footprint that will need improvements to provide adequate support of the planned structure. Therefore, PACIFICA provides two options for the support of the proposed structure.

The first option is supporting the proposed structure on shallow foundations without deep ground improvement and with conventional site preparation activities as described in Section 4.2.

Depending on the desired design soil bearing pressure, the second option, supporting the proposed structure on shallow foundations with vibro-replacement (VR, stone columns) or vibro-compaction (VC, sand), may be employed. With this option, the proposed structure can be designed with footing sizes and depths that are practical to construct and are cost-effective by allowing the loads to be transferred into more competent materials that will reduce settlement-induced damage to the proposed buildings. PACIFICA was made aware that there may be concerns regarding the vibrations caused by the installation of the vibro-replacement/vibro-compaction to the proximity of the existing buildings. Section 4.4 provides recommendations for vibration and settlement monitoring.

As an alternative to VR/VC methods, another ground stabilization technique, chemical or compaction grouting, may be employed to improve weak soil zones, compact surrounding material, and to increase the bearing capacity.

4.2 Shallow Foundation Recommendations (Conventional Site Preparation)

Shallow foundations with an allowable bearing pressure of **1,500 pounds per square foot (psf)** and placed at a minimum of 18 inches below finished floor elevation may be used to support the proposed structure. Prior to placement of shallow foundations, properly compacted existing granular soils or structural fill soils should be placed within the footprint of each shallow foundation. Recommendations in Section 5.0 shall be closely followed.

Footings widths and depths should follow, as a minimum, Florida Building Code guidelines when the geometry produces a bearing pressure less than the allowable.

Settlement estimates were determined based on the maximum column and wall foundation loads of 180 kips and 4½ kips/ft, respectively. Settlement estimates were determined from empirical relationships and based on experience with similar projects. Based on our geotechnical exploration, the required compaction recommendations in this report and the items listed in this paragraph, an estimated total settlement of 1 inch or less was calculated. Differential settlement between adjacent shallow foundations for miscellaneous structures may be approximately ½ the total estimated settlement. Due to the elastic characteristics of granular soils the settlement should be observed as soon as the live loads are applied. These settlements are usually considered to be tolerable for the proposed structures. However, if more stringent settlements are required then PACIFICA should be contacted to revise the recommendations given in this report.

We note that the proposed building addition should be structurally isolated from the existing building, to minimize the potential for excessive differential settlement to develop between the existing structure and the proposed addition.

4.3 Ground Floor Slab Recommendations

Ground floor slabs can bear directly on top of compacted structural fill material that is compacted based on requirements in Section 5.0. A modulus of subgrade reaction value of 150 pounds per cubic inch (pci) may be used for design. The underside of the ground floor slab should be lined with a vapor barrier at least 6 mil thick. A friction factor of 0.21 (ultimate) can be used for the soil to vapor barrier interface.

4.3 Shallow Foundation Recommendations with VR/VC

The proposed structure addition may be supported by shallow foundations on the improved ground using gravel columns installed by a vibro-replacement process or improved using sand by vibro-compaction. It is recommended that the owner retain an experienced VR/VC contractor that has performed work in the general area and is familiar with the subsurface conditions. The contractor should submit project profiles, and the owner interviews the contractor prior to selection.

The Specialty Contractor should determine the improvement depth to allow for an allowable bearing pressure of 6,000 to 8,000 pounds per square foot (psf) and a maximum settlement of 1 inch and a differential settlement of ½ inch. This should be verified by confirmation borings, or another viable alternative approved by the PACIFICA geotechnical engineer. The SPT N-values criteria for the confirmation borings should be provided by the specialty contractor.

The use of an H-pile driven with a hammer is not allowed for the vibro-replacement process. A vibratory probe with a fully instrumented rig should be used. Probe spacing and depth should be

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designed by a Specialty Contractor. The Specialty Contractor should submit signed and sealed plans denoting the vibro-replacement (stone columns) or vibro-compaction (sand) locations and design calculations. Both the geotechnical and structural engineers should review these plans and calculations. All fieldwork should be verified by a representative of PACIFICA and reports should be submitted to the owner for verification. **The Specialty Contractor shall act as a delegated engineer and provide signed and sealed calculations, signed and sealed shop drawings, perform the ground improvement, and provide a certification that the ground will provide an allowable bearing capacity of 6,000 to 8,000 psf with a total settlement of no more than 1 inch.** The Specialty Contractor should also evaluate the need for a load test and provide a recommendation if it is needed.

Additionally, the PACIFICA geotechnical engineer should review the gradation for the gravel columns (if Vibro-replacement is chosen). A No. 57 stone is acceptable and has been used in the past. The structural engineer should evaluate the need for anchors to resist uplift loads if needed. Please contact PACIFICA if this design issue needs to be addressed.

The use of vibro-replacement (stone columns) should not be used closer than 25 feet from an existing structure due to concerns with vibration-induced damage. Therefore, the Specialty Contractor shall evaluate alternative techniques for spot treatment in cases where proposed footings are within 25 feet of existing buildings and/or structures. Non-vibratory compaction grouting is typically used in isolated cases for ground improvement within 25 feet of an existing building and/or structure. The Specialty Contractor shall evaluate the need for compaction grouting or other alternative methods that induce vibrations within acceptable limits.

4.3 Shallow Foundation Recommendations with Chemical or Compaction Grouting

The proposed structure addition may be supported by shallow foundations on the improved ground using chemical or compaction grouting, injected below wall and column footings to improve load influence weak soil zones encountered in the upper ±20 feet of the soil horizon in the SPT borings performed within the proposed structure footprint. It is recommended that the Specialty Contractor should provide signed and sealed calculations, signed and sealed shop drawings, perform the ground improvement, and provide a certification that the ground will provide an adequate allowable bearing capacity with a total settlement of no more than 1 inch.

4.2 Vibration and Settlement Monitoring Recommendations

PACIFICA recommends that vibration and settlement monitoring be performed during performance of vibro-replacement. PACIFICA should be retained to provide vibration and settlement monitoring services on the existing adjacent buildings. Additionally, when compaction activities are taking place in proximity to the existing structures Section 5.4 should be followed.

5.0 SITE PREPARATION RECOMMENDATIONS

5.1 General Site Preparation

The results of the field investigation and experience from similar projects have yielded the following recommendations detailed in steps. These steps should be conducted by an experienced contractor adhering to current regulatory standards. It should be noted that these steps should be performed with care not to damage any adjacent structures or any underground utilities.

1) Prior to construction activities on-site underground utilities should be identified and marked in the field. If any of the existing utility lines are in conflict with the proposed construction, then plans should be made to relocate these lines. If the utilities discovered are abandoned or out of service, they should be removed.
2) Topsoil, organic soils, asphalt, concrete, unsuitable material or any other debris should be stripped to expose in-situ soils. If any old foundations from previous structures are encountered, then they should be removed in their entirety. If deep foundations are encountered the geotechnical engineer should be retained to assess the impact on the proposed structures and to make recommendations on mitigation.
3) The exposed on-site soils in footprint should be properly compacted per the recommendations in the section entitled Compaction Recommendations. The compaction should extend 5 feet beyond the perimeter of the structure.
4) Any unsuitable material or debris encountered should be removed and replaced with structural fill.
5) The contractor should prepare for heavy excavation activities as limerock or sand with limestone was encountered at relatively shallow depths at some boring locations. If limestone is encountered, special tools/buckets may be required to break the material up.
6) Any fill needed to bring up the site to the proper elevation, including any reference to structural fill in this report, should adhere to the recommendations given in the section entitled Structural Fill Soils.
7) Perform vibro-replacement (stone column) installation once the grade is raised to final elevations.
8) Perform in-place density testing at each footing location and within the slab area in accordance with the recommendations included in this report.
9) A representative of the geotechnical engineer should be present and properly document these activities.
10) Excavation adjacent to any foundation should be adequately protected and or shored.
11) Any other geotechnical related questions should be directed to the geotechnical engineer of record.

The contractor should adhere to and be aware of all OSHA and any regulatory standards during construction activities. The contractor is responsible and held solely liable if these standards are not upheld. Excavation adjacent to an existing building should be adequately protected/shored.

5.2 Dewatering Recommendations

Dewatering may be required on this site if deeper excavations are warranted. Groundwater may be pumped out using pumps or other processes to at least 2 feet below and compaction activities. Well, point systems may be used if deeper excavations are required for proper and safe construction (if wellpoints extend to the limestone, special tools for installation may be required due to the hard material). A specialty contractor should design these systems and adhere to any regulatory standards.

5.3 Compaction Recommendations for Ground Improvement

Once initial site clearing has been performed and after Soil improvement has been performed, the exposed in-situ soils in the building(s) footprint should be properly compacted until the surface is firm and unyielding. The compaction should extend 5 feet beyond the perimeter of the building(s). Care should be taken when compacting adjacent to existing structures. A self-propelled vibratory roller of no less than 40,000 pounds should be used to compact the exposed

in-situ soils. The proof rolling should be observed by PACIFICA to identify and mitigate any weak subgrade conditions.

If any locations of in-situ soils overly deflect under the weight of the roller, then the soils should be removed to a depth of 24 inches and replaced with properly compacted structural fill materials. The structural fill soils should be compacted to 98% of the Modified Proctor maximum dry density per ASTM D1557. Wetting of the subgrade soils may be used in order to achieve proper compaction.

5.4 Compaction Recommendations for Areas Close to the Existing Structures

Once initial site clearing has been performed, the exposed in-situ soils in the building(s) footprint should be properly compacted until the surface is firm and unyielding. The compaction should extend 5 feet beyond the perimeter of the building. Care should be taken when compacting adjacent to existing structures. The in-situ soils should be compacted using a self-propelled vibratory roller, in static mode, no less than 40,000 pounds. The proof rolling should be observed by PACIFICA to identify and mitigate any weak subgrade conditions.

If any locations of in-situ soils overly deflect under the weight of the roller then the soils should be removed to a depth of 24 inches and replaced with properly compacted structural fill materials. The structural fill soils should be compacted to 98% of the Modified Proctor maximum dry density per ASTM D1557. Wetting of the subgrade soils may be used in order to achieve proper compaction.

5.5 Structural Fill Soils

Structural fill soils should be inorganic and consist of granular material containing less than 12 percent passing the U.S. Standard No. 200 mesh sieve, a maximum particle size of 3 inches and have a Unified Soil Classification System (USCS) designation of GP, GW, GP-GM, GW-GM, SP, SW, SP-SM, or SW-SM. The structural fill material may be composed of either clean sands and/or limerock.

Density tests should be performed by a qualified technician working under the supervision of the geotechnical engineer and be in accordance with the appropriate ASTM standards. The representative of the geotechnical engineer should be present and agree with the placement and compaction of all structural fill materials.

Loose lifts not exceeding 12 inches should be performed on all structural fill materials. The lifts should be compacted to 98% of the Modified Proctor (ASTM D1557). If a small vibratory plate or roller is used, then loose lifts should not exceed 8 inches.

6.0 PAVEMENT RECOMMENDATIONS

We understand that the infrastructure for the planned development will include flexible (asphalt) pavements for the entrance drives and parking areas. Based on the results of our test borings, the subsurface conditions encountered appear to be adaptable for supporting these pavement sections.

Based on our experience, we recommend the following minimum pavement section. Actual pavement sections should be designed and determined by the project civil engineer based on the anticipated traffic, desired pavement life and performance expectations. The proposed pavements

within the development should conform to all applicable County and Florida DOT requirements for design and construction.

We recommend a minimum compaction requirement of 98% of the maximum dry density be specified for the base and stabilized subgrade courses as determined by the Modified Proctor test method (ASTM D-1557).

TABLE 2: FLEXIBLE PAVEMENT SECTION RECOMMENDATIONS

STANDARD DUTY PAVEMENT SECTION	
Asphaltic Concrete Surface Course (such as a 9.5 mm SuperPave approved FDOT mix)	1 inch
Asphaltic Concrete Structural Course (such as a 12.5 mm SuperPave approved FDOT mix)	1½ inch
FDOT Approved Limerock Base or Graded Aggregate Base (GAB) Material	6 inches
Stabilized Subgrade Course (minimum LBR of 40)	12 inches

Based on visual classification of the near-surface materials encountered in the test borings, it appears that the native sandy soils may not meet the minimum LBR requirement of 40 for the stabilized subgrade course (SSC), and therefore stabilization of the native subgrade soils should be anticipated for this project if the pavement sections will be installed at/near current site grade elevations. An imported material having a minimum LBR value of 40 should be specified for the final (12-inch) lift of fill for pavement areas being installed over fill.

The above pavement sections and thicknesses were based on assumed values taken from similar projects. A Civil Engineer should perform a design once traffic loading and estimates are finalized. The design pavement section shall meet minimum city/county requirements.

7.0 REPORT LIMITATIONS

These geotechnical engineering services have been performed, findings obtained, and recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices at the time of this report. PACIFICA is not responsible for the conclusions, opinions, or recommendations made by others based on this data. No other warranties are implied or expressed.

If PACIFICA is not afforded the opportunity to participate in construction related aspects of foundation installation as recommended in this report, we can accept no responsibility for the interpretation of our recommendations made in this preliminary report or for foundation performance.

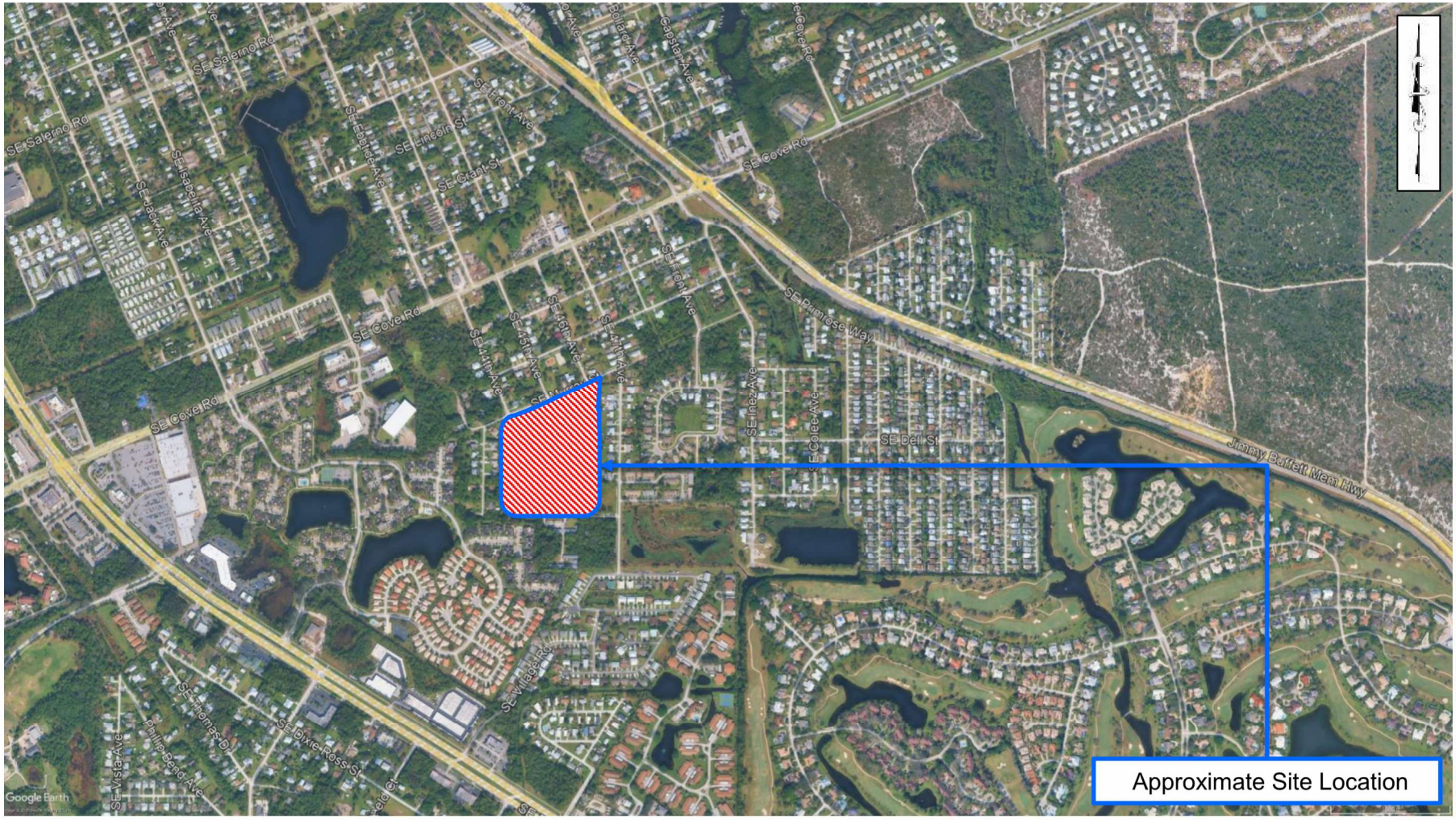
The scope of the investigation was intended to evaluate soil conditions within the influence of the proposed foundations. The analyses and recommendations submitted in this report are based upon the data obtained from the soil borings performed at the locations indicated. If any subsoil variations become evident during the course of this project, a re-evaluation of the recommendations contained in this report will be necessary after we have had an opportunity to observe the characteristics of the conditions encountered. The applicability of the report should also be reviewed in the event significant changes occur in the design, nature, or location of the proposed structures. The scope of our services did not include an environmental assessment for the presence or absence of hazardous or toxic materials in the soil and groundwater. Any statements in this report regarding odors, staining of soils, or other unusual conditions observed are strictly for the information of our client.

This report has been prepared for the exclusive use of Hedrick Brothers and their design consultants for the proposed development in Stuart, Florida.

HB ESTIMATING REC'D 06.01.2026

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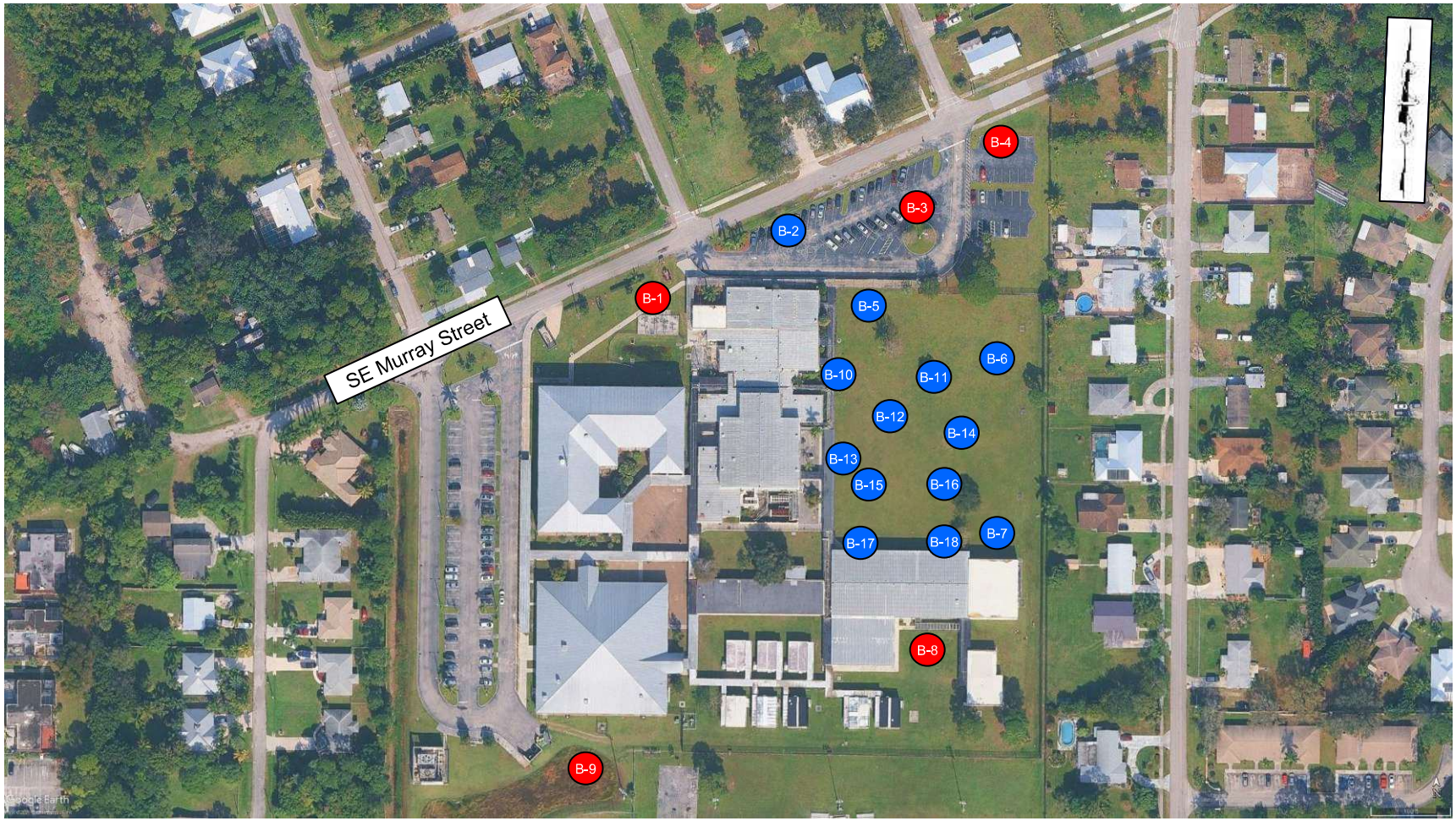
SITE VICINITY MAP



GEOTECHNICAL ENGINEERING SERVICES MCSD Murray Middle School Modernization 4400 SE Murray Street, Stuart, Florida		DATE: 02/04/2026 DRAWN: KN
SHEET NO.: 1	PACIFICA PROJ. NO: 320-26632	CHKD: AK

PACIFICA ENGINEERING SERVICES

BORING LOCATION PLAN - AERIAL



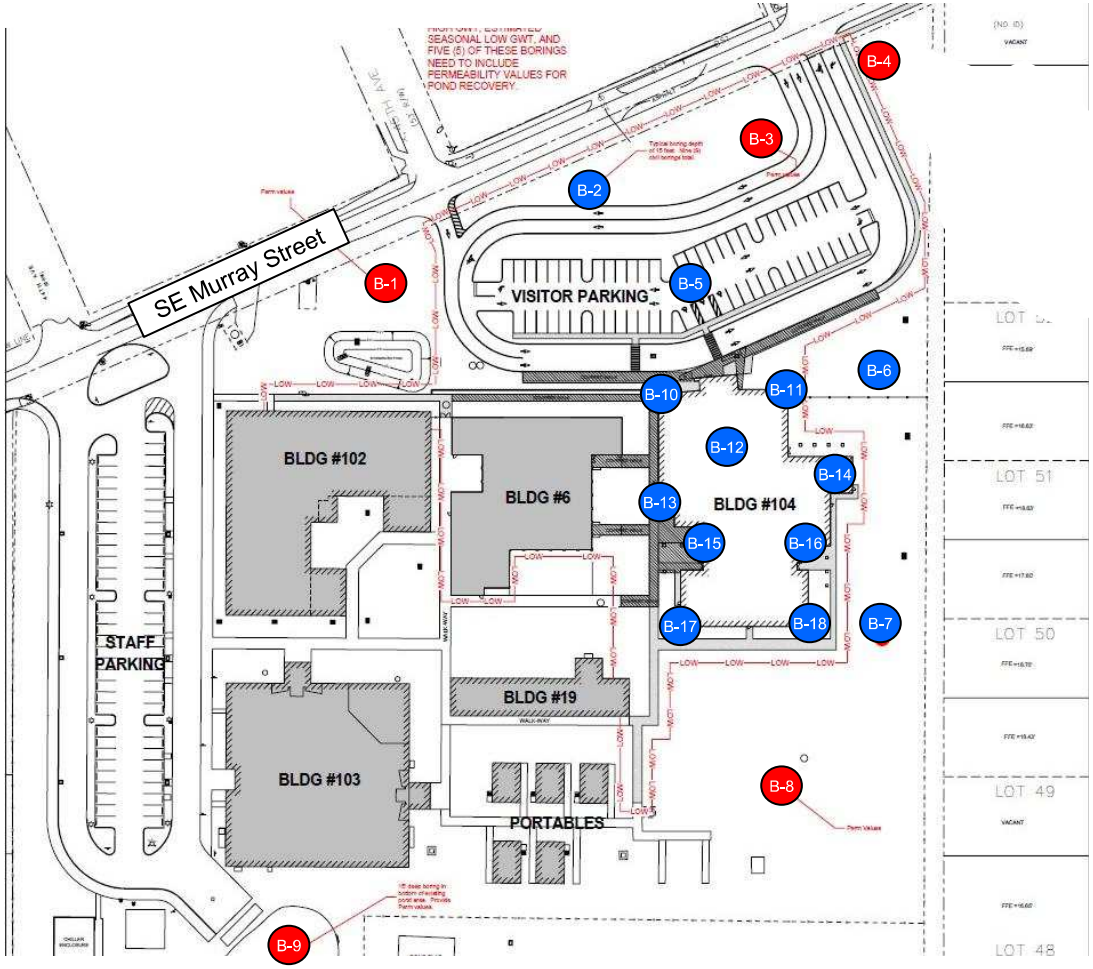
B-# **Approximate SPT Boring / Percolation Test Location**

B-# **Approximate SPT Boring Location**

GEOTECHNICAL ENGINEERING SERVICES MCSD Murray Middle School Modernization 4400 SE Murray Street, Stuart, Florida		DATE: 02/04/2026 DRAWN: KN
SHEET NO.: 2	PACIFICA PROJ. NO: 320-26632	CHKD: AK

PACIFICA ENGINEERING SERVICES

BORING LOCATION PLAN – SITE





B-# Approximate SPT Boring / Percolation Test Location

B-# Approximate SPT Boring Location

GEOTECHNICAL ENGINEERING SERVICES MCSD Murray Middle School Modernization 4400 SE Murray Street, Stuart, Florida		DATE: 02/04/2026 DRAWN: KN
SHEET NO.: 3	PACIFICA PROJ. NO: 320-26632	CHKD: AK

PACIFICA ENGINEERING SERVICES

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HB ESTIMATING REC'D 06.01.2026

Test Boring Log

Client	**Hedrick Brothers**	Boring No.	**B-1**
Project	MCSD Murray Middle School Modernization	Date Started	1/27/2026
Boring Location	See Boring Location Plan	Date Completed	1/27/2026
Elev. Ref.	N/A	Project No.	320-26632
Remarks	The stratification lines represent approximate boundaries.	Sheet No.	1 of 1
	The transition may be gradual.	Ground Water Depth	7.0 feet

ELEV. (ft)	Depth (ft)	Graphic Log	DESCRIPTION OF MATERIALS	SAMPLE No.	Type	USCS Classification	Blows	REC-OVERY	REC %	SPT N. Value
	0.0		3" Topsoil / Medium Dense, Brown Fine SAND	1		SP	10-7-8-9			15
	2.0			2			6-4-5-4			9
	4.0			3			8-11-14-17			25
	6.0		Medium Dense to Dense, Brown Fine SAND with Few to Trace Organics and Silt	4		SP-SM	4-8-14-16			22
▼	8.0		- Recovery from 4 to 6 FT: MC=19.5%, OC=6.9%, Fines=11.2%	5			6-7-9-10			16
	10.0									
	12.0									
	14.0		Medium Dense, Brown Fine SAND	6		SP	8-8-6-7			14
	16.0		Boring Terminated at 15.0 feet							

HB ESTIMATING REC'D 06.01.2026

General Notes

Driller:	L.S.
Hammer Type:	Automatic
Rig Type	CME55
Drilling Method	SPT

601 North Congress Avenue - Suite 303 | Delray Beach, Florida 33445
(561) 419-8460

SPT Split Spoon Sampler
Groundwater at Time of Drilling
WOH= Weight of Hammer

Test Boring Log

Client	**Hedrick Brothers**	Boring No.	**B-2**
Project	MCSD Murray Middle School Modernization	Date Started	1/27/2026
Boring Location	See Boring Location Plan	Date Completed	1/27/2026
Elev. Ref.	N/A	Project No.	320-26632
Remarks	The stratification lines represent approximate boundaries.	Sheet No.	1 of 1
	The transition may be gradual.	Ground Water Depth	6.0 feet

ELEV. (ft)	Depth (ft)	Graphic Log	DESCRIPTION OF MATERIALS	SAMPLE No.	Type	USCS Classification	Blows	REC-OVERY	REC %	SPT N. Value
	0.0									
	2.0			1			21-10-11-13			21
	4.0			2			13-11-8-9			19
▼	6.0			3			8-10-11-7			21
	8.0		0.5" Asphalt / Medium Dense to Dense, Brown Fine SAND	4		SP	6-8-12-10			20
	10.0			5			7-11-14-13			25
	12.0									
	14.0			6			8-8-9-11			17
	16.0		Boring Terminated at 15.0 feet							

HB ESTIMATING REC'D 06.01.2026

General Notes

Driller:	L.S.
Hammer Type:	Automatic
Rig Type	CME55
Drilling Method	SPT

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(561) 419-8460

SPT Split Spoon Sampler
▼ Groundwater at Time of Drilling
WOH= Weight of Hammer

Test Boring Log

Client	**Hedrick Brothers**	Boring No.	**B-3**
Project	MCSD Murray Middle School Modernization	Date Started	1/27/2025
Boring Location	See Boring Location Plan	Date Completed	1/27/2025
Elev. Ref.	N/A	Project No.	320-26632
Remarks	The stratification lines represent approximate boundaries.	Sheet No.	1 of 1
	The transition may be gradual.	Ground Water Depth	6.0 feet

ELEV. (ft)	Depth (ft)	Graphic Log	DESCRIPTION OF MATERIALS	SAMPLE No.	Type	USCS Classification	Blows	REC-OVERY	REC %	SPT N. Value
	0.0									
	2.0			1			18-7-6-4			13
	4.0			2			4-2-3-4			5
▼	6.0			3			2-1-2-3			3
	8.0		1" Asphalt / Loose to Medium Dense, Gray to Brown Fine SAND	4		SP	4-3-5-4			8
	10.0			5			6-4-7-5			11
	12.0									
	14.0			6			4-7-5-4			12
	16.0		Boring Terminated at 15.0 feet							

HB ESTIMATING REC'D 06.01.2026

General Notes

Driller:	L.S.
Hammer Type:	Automatic
Rig Type	CME55
Drilling Method	SPT

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(561) 419-8460

SPT Split Spoon Sampler
▼ Groundwater at Time of Drilling
WOH= Weight of Hammer

Test Boring Log

Client	**Hedrick Brothers**	Boring No.	**B-4**
Project	MCSD Murray Middle School Modernization	Date Started	1/27/2026
Boring Location	See Boring Location Plan	Date Completed	1/27/2026
Elev. Ref.	N/A	Project No.	320-26632
Remarks	The stratification lines represent approximate boundaries.	Sheet No.	1 of 1
	The transition may be gradual.	Ground Water Depth	6.0 feet

ELEV. (ft)	Depth (ft)	Graphic Log	DESCRIPTION OF MATERIALS	SAMPLE No.	Type	USCS Classification	Blows	REC-OVERY	REC %	SPT N. Value
	0.0		1" Asphalt / Medium Dense, Gray to Brown Fine SAND with Few Limerock	1		SP	10-7-4-5			11
	2.0			2			4-3-2-2			5
	4.0			3			2-3-2-4			5
▼	6.0			4			4-6-4-3			10
	8.0		Loose to Medium Dense, Gray to Brown Fine SAND	5		SP	6-5-4-4			9
	10.0									
	12.0									
	14.0			6			4-6-3-4			9
	16.0		Boring Terminated at 15.0 feet							

HB ESTIMATING REC'D 06.01.2026

General Notes

Driller:	W.S.
Hammer Type:	Automatic
Rig Type	7822DT
Drilling Method	SPT

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(561) 419-8460

SPT Split Spoon Sampler
Groundwater at Time of Drilling
WOH= Weight of Hammer

Test Boring Log

Client	**Hedrick Brothers**	Boring No.	**B-5**
Project	MCSD Murray Middle School Modernization	Date Started	1/28/2026
Boring Location	See Boring Location Plan	Date Completed	1/28/2026
Elev. Ref.	N/A	Project No.	320-26632
Remarks	The stratification lines represent approximate boundaries.	Sheet No.	1 of 1
	The transition may be gradual.	Ground Water Depth	7.0 feet

ELEV. (ft)	Depth (ft)	Graphic Log	DESCRIPTION OF MATERIALS	SAMPLE No.	Type	USCS Classification	Blows	REC-OVERY	REC %	SPT N. Value
	0.0									
	2.0		3" Topsoil / Medium Dense, Brown Fine SAND	1		SP	6-8-7-4			15
	4.0			2			10-7-8-5			15
	6.0			3			12-13-10-7			23
▼	8.0		Medium Dense, Brown Fine SAND with Few to Trace Organics and Silt	4		SP-SM	6-4-7-5			11
	10.0			5			9-3-6-4			9
	12.0									
	14.0		Loose, Brown Fine SAND	6		SP	4-3-4-5			7
	16.0		Boring Terminated at 15.0 feet							

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General Notes

Driller:	L.S.
Hammer Type:	Automatic
Rig Type	CME55
Drilling Method	SPT

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(561) 419-8460

SPT Split Spoon Sampler
Groundwater at Time of Drilling
WOH= Weight of Hammer

Test Boring Log

Client	**Hedrick Brothers**	Boring No.	**B-6**
Project	MCSD Murray Middle School Modernization	Date Started	1/28/2026
Boring Location	See Boring Location Plan	Date Completed	1/28/2026
Elev. Ref.	N/A	Project No.	320-26632
Remarks	The stratification lines represent approximate boundaries.	Sheet No.	1 of 1
	The transition may be gradual.	Ground Water Depth	7.0 feet

ELEV. (ft)	Depth (ft)	Graphic Log	DESCRIPTION OF MATERIALS	SAMPLE No.	Type	USCS Classification	Blows	REC-OVERY	REC %	SPT N. Value
	0.0									
	2.0		3" Topsoil / Medium Dense, Brown Fine SAND	1		SP	16-11-8-9			19
	4.0			2			10-7-8-6			15
	6.0			3			6-6-9-11			15
▼	8.0		Medium Dense, Brown Fine SAND with Few to Trace Organics and Silt	4			7-7-8-8			15
	10.0		- Recovery from 6 to 8 FT: MC=22.2%, OC=6.3%	5		SP-SM	6-8-9-6			17
	12.0									
	14.0		Medium Dense, Brown Fine SAND	6		SP	5-7-8-7			15
	16.0		Boring Terminated at 15.0 feet							

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General Notes

Driller:	L.S.
Hammer Type:	Automatic
Rig Type	CME55
Drilling Method	SPT

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(561) 419-8460

SPT Split Spoon Sampler
Groundwater at Time of Drilling
WOH= Weight of Hammer

Test Boring Log

Client	**Hedrick Brothers**	Boring No.	**B-7**
Project	MCSD Murray Middle School Modernization	Date Started	1/28/2026
Boring Location	See Boring Location Plan	Date Completed	1/28/2026
Elev. Ref.	N/A	Project No.	320-26632
Remarks	The stratification lines represent approximate boundaries.	Sheet No.	1 of 1
	The transition may be gradual.	Ground Water Depth	7.0 feet

ELEV. (ft)	Depth (ft)	Graphic Log	DESCRIPTION OF MATERIALS	SAMPLE No.	Type	USCS Classification	Blows	REC-OVERY	REC %	SPT N. Value
	0.0									
	2.0		3" Topsoil / Medium Dense, Brown Fine SAND	1		SP	4-7-3-3			10
	4.0			2			6-4-3-7			7
	6.0			3			4-8-7-4			15
▼	8.0		Loose to Medium Dense, Brown Fine SAND with Few to Trace Organics and Silt	4		SP-SM	7-9-6-8			15
	10.0			5			4-7-10-12			17
	12.0									
	14.0		Medium Dense, Brown Fine SAND	6		SP	6-7-4-5			11
	16.0		Boring Terminated at 15.0 feet							

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General Notes

Driller:	L.S.
Hammer Type:	Automatic
Rig Type	CME55
Drilling Method	SPT

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(561) 419-8460

SPT Split Spoon Sampler
Groundwater at Time of Drilling
WOH= Weight of Hammer

Test Boring Log

Client	**Hedrick Brothers**	Boring No.	**B-8**
Project	MCSD Murray Middle School Modernization	Date Started	1/29/2026
Boring Location	See Boring Location Plan	Date Completed	1/29/2026
Elev. Ref.	N/A	Project No.	320-26632
Remarks	The stratification lines represent approximate boundaries.	Sheet No.	1 of 1
	The transition may be gradual.	Ground Water Depth	7.0 feet

ELEV. (ft)	Depth (ft)	Graphic Log	DESCRIPTION OF MATERIALS	SAMPLE No.	Type	USCS Classification	Blows	REC-OVERY	REC %	SPT N. Value
	0.0									
	2.0			1			9-8-9-7			17
	4.0			2			4-5-6-4			11
	6.0			3			2-3-4-3			7
▼	8.0		3" Topsoil / Loose to Medium Dense, Gray to Brown Fine SAND	4		SP	4-4-3-5			7
	10.0			5			6-4-7-5			11
	12.0									
	14.0			6			8-6-4-7			10
	16.0		Boring Terminated at 15.0 feet							

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General Notes

Driller:	L.S.
Hammer Type:	Automatic
Rig Type	CME55
Drilling Method	SPT

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SPT Split Spoon Sampler
Groundwater at Time of Drilling
WOH= Weight of Hammer

Test Boring Log

Client	**Hedrick Brothers**	Boring No.	**B-9**
Project	MCSD Murray Middle School Modernization	Date Started	1/27/2026
Boring Location	See Boring Location Plan	Date Completed	1/27/2026
Elev. Ref.	N/A	Project No.	320-26632
Remarks	The stratification lines represent approximate boundaries.	Sheet No.	1 of 1
	The transition may be gradual.	Ground Water Depth	4.0 feet

ELEV. (ft)	Depth (ft)	Graphic Log	DESCRIPTION OF MATERIALS	SAMPLE No.	Type	USCS Classification	Blows	REC-OVERY	REC %	SPT N. Value
	0.0			1			2-3-4-4			7
	2.0			2			2-3-2-3			5
▼	4.0			3			4-6-3-4			9
	6.0			4			3-5-4-3			9
	8.0		3" Topsoil / Loose to Medium Dense, Brown Fine SAND	5		SP	4-3-3-2			6
	10.0									
	12.0									
	14.0			6			5-3-6-4			9
	16.0		Boring Terminated at 15.0 feet							

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General Notes

Driller:	W.S.
Hammer Type:	Automatic
Rig Type	7822DT
Drilling Method	SPT

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(561) 419-8460

SPT Split Spoon Sampler
Groundwater at Time of Drilling
WOH= Weight of Hammer

Test Boring Log

Client	**Hedrick Brothers**	Boring No.	**B-10**
Project	MCSD Murray Middle School Modernization	Date Started	1/29/2026
Boring Location	See Boring Location Plan	Date Completed	1/29/2026
Elev. Ref.	N/A	Project No.	320-26632
Remarks	The stratification lines represent approximate boundaries.	Sheet No.	1 of 1
	The transition may be gradual.	Ground Water Depth	7.0 feet

ELEV. (ft)	Depth (ft)	Graphic Log	DESCRIPTION OF MATERIALS	SAMPLE No.	Type	USCS Classification	Blows	REC-OVERY	REC %	SPT N. Value
	0.0									
	2.0		3" Topsoil / Loose to Medium Dense, Gray to Brown Fine SAND	1		SP	10-8-9-7			17
	4.0			2			4-3-2-1			5
	6.0			3			2-3-1-1			4
▼	8.0		Loose, Brown Fine SAND with Few to Trace Organics and Silt	4		SP-SM	4-3-5-1			8
	10.0			5			2-2-1-1			3
	12.0									
	14.0		Loose to Medium Dense, Brown Fine SAND	6		SP	2-3-4-2			7
	16.0									
	18.0									
	20.0			7			3-5-7-8			12
	22.0									
	24.0			8			9-6-8-5			14
	26.0									
	28.0									
	30.0		Medium Dense to Very Dense, Gray Fine SAND with Few to Trace Shell Fragments	9		SP	11-13-16-18			29
	32.0		**HB ESTIMATING REC'D 06.01.2026**							
	34.0			10			21-32-19-24			51
	36.0		Boring Terminated at 35.0 feet							

General Notes

Driller:	L.S.
Hammer Type:	Automatic
Rig Type	CME55
Drilling Method	SPT

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(561) 419-8460

SPT Split Spoon Sampler
Groundwater at Time of Drilling
WOH= Weight of Hammer

Test Boring Log

Client	**Hedrick Brothers**	Boring No.	**B-11**
Project	MCSD Murray Middle School Modernization	Date Started	1/30/2026
Boring Location	See Boring Location Plan	Date Completed	1/30/2026
Elev. Ref.	N/A	Project No.	320-26632
Remarks	The stratification lines represent approximate boundaries.	Sheet No.	1 of 1
	The transition may be gradual.	Ground Water Depth	7.0 feet

ELEV. (ft)	Depth (ft)	Graphic Log	DESCRIPTION OF MATERIALS	SAMPLE No.	Type	USCS Classification	Blows	REC-OVERY	REC %	SPT N. Value
	0.0									
	2.0		3" Topsoil / Loose to Medium Dense, Brown Fine SAND	1		SP	6-4-4-3			8
	4.0			2			5-7-6-8			13
	6.0			3			5-8-7-6			15
▼	8.0		Medium Dense, Brown Fine SAND with Few to Trace Organics and Silt	4		SP-SM	5-4-8-11			12
	10.0			5			11-10-7-9			17
	12.0									
	14.0			6			4-3-2-4			5
	16.0		Loose, Brown Fine SAND			SP				
	18.0									
	20.0			7			3-1-2-3			3
	22.0									
	24.0			8			3-3-4-3			7
	26.0		Loose to Medium Dense, Gray Fine SAND with Few to Trace Shell Fragments			SP				
	28.0									
	30.0			9			4-7-4-5			11
	32.0		**HB ESTIMATING REC'D 06.01.2026**							
	34.0			10			6-5-6-4			11
	36.0		Boring Terminated at 35.0 feet							

General Notes

Driller:	L.S.
Hammer Type:	Automatic
Rig Type	CME55
Drilling Method	SPT

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(561) 419-8460

SPT Split Spoon Sampler
Groundwater at Time of Drilling
WOH= Weight of Hammer

Test Boring Log

Client	**Hedrick Brothers**	Boring No.	**B-12**
Project	MCSD Murray Middle School Modernization	Date Started	1/30/2026
Boring Location	See Boring Location Plan	Date Completed	1/30/2026
Elev. Ref.	N/A	Project No.	320-26632
Remarks	The stratification lines represent approximate boundaries.	Sheet No.	1 of 1
	The transition may be gradual.	Ground Water Depth	7.0 feet

ELEV. (ft)	Depth (ft)	Graphic Log	DESCRIPTION OF MATERIALS	SAMPLE No.	Type	USCS Classification	Blows	REC-OVERY	REC %	SPT N. Value
	0.0									
	2.0		3" Topsoil / Loose to Medium Dense, Brown Fine SAND	1		SP	4-3-4-5			7
	4.0			2			2-3-6-7			9
▼	6.0			3			5-8-9-10			17
	8.0			4			10-14-16-14			30
	10.0		Medium Dense to Dense, Brown Fine SAND with Few to Trace Organics and Silt	5		SP-SM	12-11-9-8			20
	12.0									
	14.0			6			10-7-8-6			15
	16.0		Medium Dense, Brown Fine SAND			SP				
	18.0									
	20.0			7			4-7-6-6			13
	22.0									
	24.0			8			5-8-6-7			14
	26.0		Medium Dense, Gray Fine SAND with Few to Trace Shell Fragments			SP				
	28.0									
	30.0			9			7-4-6-5			10
	32.0		**HB ESTIMATING REC'D 06.01.2026**							
	34.0			10			6-8-7-8			15
	36.0		Boring Terminated at 35.0 feet							

General Notes

Driller:	L.S.
Hammer Type:	Automatic
Rig Type	CME55
Drilling Method	SPT

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SPT Split Spoon Sampler
Groundwater at Time of Drilling
WOH= Weight of Hammer

Test Boring Log

Client	**Hedrick Brothers**	Boring No.	**B-13**
Project	MCSD Murray Middle School Modernization	Date Started	1/29/2026
Boring Location	See Boring Location Plan	Date Completed	1/29/2026
Elev. Ref.	N/A	Project No.	320-26632
Remarks	The stratification lines represent approximate boundaries.	Sheet No.	1 of 1
	The transition may be gradual.	Ground Water Depth	7.0 feet

ELEV. (ft)	Depth (ft)	Graphic Log	DESCRIPTION OF MATERIALS	SAMPLE No.	Type	USCS Classification	Blows	REC-OVERY	REC %	SPT N. Value
	0.0									
	2.0		3" Topsoil / Medium Dense to Dense, Brown Fine SAND	1	◪	SP	10-11-7-8			18
	4.0			2	◪		6-8-9-12			17
	6.0			3	◪		13-15-10-16			25
▼	8.0			4	◪		14-10-9-8			19
	10.0		Medium Dense, Brown Fine SAND with Few to Trace Organics and Silt	5	◪	SP-SM	7-11-13-14			24
	12.0									
	14.0			6	◪		4-2-1-3			3
	16.0		Loose, Brown Fine SAND			SP				
	18.0									
	20.0			7	◪		2-3-4-5			7
	22.0									
	24.0			8	◪		10-13-11-14			24
	26.0		Loose to Medium Dense, Gray Fine SAND with Few to Trace Shell Fragments			SP				
	28.0									
	30.0			9	◪		12-9-10-14			19
	32.0		**HB ESTIMATING REC'D 06.01.2026**							
	34.0			10	◪		15-13-11-9			24
	36.0		Boring Terminated at 35.0 feet							

General Notes

Driller:	L.S.
Hammer Type:	Automatic
Rig Type	CME55
Drilling Method	SPT

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(561) 419-8460

◪ SPT Split Spoon Sampler
▼ Groundwater at Time of Drilling
WOH= Weight of Hammer

Test Boring Log

Client	**Hedrick Brothers**	Boring No.	**B-14**
Project	MCSD Murray Middle School Modernization	Date Started	1/30/2026
Boring Location	See Boring Location Plan	Date Completed	1/30/2026
Elev. Ref.	N/A	Project No.	320-26632
Remarks	The stratification lines represent approximate boundaries.	Sheet No.	1 of 1
	The transition may be gradual.	Ground Water Depth	7.0 feet

ELEV. (ft)	Depth (ft)	Graphic Log	DESCRIPTION OF MATERIALS	SAMPLE No.	Type	USCS Classification	Blows	REC-OVERY	REC %	SPT N. Value
	0.0									
	2.0		3" Topsoil / Medium Dense, Brown Fine SAND	1		SP	3-5-8-6			13
	4.0			2			8-6-5-5			11
	6.0			3			5-4-6-7			10
▼	8.0		Medium Dense, Brown Fine SAND with Few to Trace Organics and Silt	4		SP-SM	4-6-7-5			13
	10.0			5			5-6-8-8			14
	12.0									
	14.0			6			3-5-4-5			9
	16.0									
	18.0		Medium Dense, Brown Fine SAND			SP				
	20.0			7			3-4-5-3			9
	22.0									
	24.0			8			6-10-4-6			14
	26.0									
	28.0									
	30.0		Medium Dense, Gray Fine SAND with Few to Trace Shell Fragments	9		SP	3-6-7-5			13
	32.0		**HB ESTIMATING REC'D 06.01.2026**							
	34.0			10			6-7-5-5			12
	36.0		Boring Terminated at 35.0 feet							

General Notes

Driller:	W.S
Hammer Type:	Automatic
Rig Type	7822DT
Drilling Method	SPT

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SPT Split Spoon Sampler
Groundwater at Time of Drilling
WOH= Weight of Hammer

Test Boring Log

Client	**Hedrick Brothers**	Boring No.	**B-15**
Project	MCSD Murray Middle School Modernization	Date Started	1/30/2026
Boring Location	See Boring Location Plan	Date Completed	1/30/2026
Elev. Ref.	N/A	Project No.	320-26632
Remarks	The stratification lines represent approximate boundaries.	Sheet No.	1 of 1
	The transition may be gradual.	Ground Water Depth	7.0 feet

ELEV. (ft)	Depth (ft)	Graphic Log	DESCRIPTION OF MATERIALS	SAMPLE No.	Type	USCS Classification	Blows	REC-OVERY	REC %	SPT N. Value
	0.0									
	2.0		3" Topsoil / Medium Dense to Dense, Brown Fine SAND	1		SP	4-6-9-7			15
	4.0			2			10-14-16-12			30
	6.0			3			12-12-11-9			23
▼	8.0		Medium Dense, Brown Fine SAND with Few to Trace Organics and Silt	4			7-4-3-4			7
	10.0		- Recovery from 4 to 6 FT: MC=24.5%, OC=9.1%	5		SP-SM	5-6-8-8			14
	12.0									
	14.0			6			10-7-6-4			13
	16.0		Medium Dense, Brown Fine SAND			SP				
	18.0									
	20.0			7			2-3-4-7			7
	22.0									
	24.0			8			6-4-7-6			11
	26.0		Loose to Medium Dense, Gray Fine SAND with Few to Trace Shell Fragments			SP				
	28.0									
	30.0			9			7-9-8-8			17
	32.0		**HB ESTIMATING REC'D 06.01.2026**							
	34.0			10			9-8-10-7			18
	36.0		Boring Terminated at 35.0 feet							

General Notes

Driller:	L.S.
Hammer Type:	Automatic
Rig Type	CME55
Drilling Method	SPT

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SPT Split Spoon Sampler
Groundwater at Time of Drilling
WOH= Weight of Hammer

Test Boring Log

Client	**Hedrick Brothers**	Boring No.	**B-16**
Project	MCSD Murray Middle School Modernization	Date Started	1/30/2026
Boring Location	See Boring Location Plan	Date Completed	1/30/2026
Elev. Ref.	N/A	Project No.	320-26632
Remarks	The stratification lines represent approximate boundaries.	Sheet No.	1 of 1
	The transition may be gradual.	Ground Water Depth	7.0 feet

ELEV. (ft)	Depth (ft)	Graphic Log	DESCRIPTION OF MATERIALS	SAMPLE No.	Type	USCS Classification	Blows	REC-OVERY	REC %	SPT N. Value
	0.0									
	2.0		3" Topsoil / Medium Dense to Dense, Brown Fine SAND	1		SP	3-4-6-7			10
	4.0			2			9-13-17-20			30
	6.0			3			5-10-12-10			22
▼	8.0		Medium Dense to Dense, Brown Fine SAND with Few to Trace Organics and Silt	4		SP-SM	11-9-10-12			19
	10.0			5			7-12-13-11			25
	12.0									
	14.0			6			5-7-6-5			13
	16.0		Medium Dense, Brown Fine SAND			SP				
	18.0									
	20.0			7			4-6-8-5			14
	22.0									
	24.0			8			5-7-8-4			15
	26.0		Medium Dense, Gray Fine SAND with Few to Trace Shell Fragments			SP				
	28.0									
	30.0			9			4-6-5-6			11
	32.0		**HB ESTIMATING REC'D 06.01.2026**							
	34.0			10			6-7-4-5			11
	36.0		Boring Terminated at 35.0 feet							

General Notes

Driller:	W.S.
Hammer Type:	Automatic
Rig Type	7822DT
Drilling Method	SPT

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SPT Split Spoon Sampler
Groundwater at Time of Drilling
WOH= Weight of Hammer

Test Boring Log

Client	**Hedrick Brothers**	Boring No.	**B-17**
Project	MCSD Murray Middle School Modernization	Date Started	1/29/2026
Boring Location	See Boring Location Plan	Date Completed	1/29/2026
Elev. Ref.	N/A	Project No.	320-26632
Remarks	The stratification lines represent approximate boundaries.	Sheet No.	1 of 1
	The transition may be gradual.	Ground Water Depth	7.0 feet

ELEV. (ft)	Depth (ft)	Graphic Log	DESCRIPTION OF MATERIALS	SAMPLE No.	Type	USCS Classification	Blows	REC-OVERY	REC %	SPT N. Value
	0.0			1			6-6-7-9			13
	2.0			2			7-4-3-5			7
	4.0			3			9-8-6-4			14
▼	6.0			4			7-9-5-4			14
	8.0			5			3-6-8-10			14
	10.0		3" Topsoil / Loose to Medium Dense, Gray to Brown Fine SAND			SP				
	12.0									
	14.0			6			6-4-5-5			9
	16.0									
	18.0									
	20.0			7			7-4-8-9			12
	22.0									
	24.0			8			4-3-3-5			6
	26.0									
	28.0		Loose to Dense, Gray Fine SAND with Few to Trace Shell Fragments			SP				
	30.0			9			15-16-13-16			29
	32.0		**HB ESTIMATING REC'D 06.01.2026**							
	34.0			10			17-20-19-20			39
	36.0		Boring Terminated at 35.0 feet							

General Notes

Driller:	L.S.
Hammer Type:	Automatic
Rig Type	CME55
Drilling Method	SPT

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SPT Split Spoon Sampler
Groundwater at Time of Drilling
WOH= Weight of Hammer

Test Boring Log

Client	**Hedrick Brothers**	Boring No.	**B-18**
Project	MCSD Murray Middle School Modernization	Date Started	2/3/2026
Boring Location	See Boring Location Plan	Date Completed	2/3/2026
Elev. Ref.	N/A	Project No.	320-26632
Remarks	The stratification lines represent approximate boundaries.	Sheet No.	1 of 1
	The transition may be gradual.	Ground Water Depth	7.0 feet

ELEV. (ft)	Depth (ft)	Graphic Log	DESCRIPTION OF MATERIALS	SAMPLE No.	Type	USCS Classification	Blows	REC-OVERY	REC %	SPT N. Value
	0.0									
	2.0			1			3-2-3-3			5
	4.0			2			2-5-4-3			9
	6.0			3			6-8-5-7			13
▼	8.0			4			7-12-9-6			21
	10.0		3" Topsoil / Loose to Medium Dense, Gray to Brown Fine SAND	5		SP	8-10-7-8			17
	12.0									
	14.0			6			3-5-4-3			9
	16.0									
	18.0									
	20.0			7			3-6-4-4			10
	22.0									
	24.0			8			5-6-6-5			12
	26.0		Medium Dense, Gray Fine SAND with Few to Trace Shell Fragments			SP				
	28.0			9			4-7-6-5			13
	30.0									
	32.0		**HB ESTIMATING REC'D 06.01.2026**	10			5-7-6-6			13
	34.0									
	36.0		Boring Terminated at 35.0 feet							

General Notes

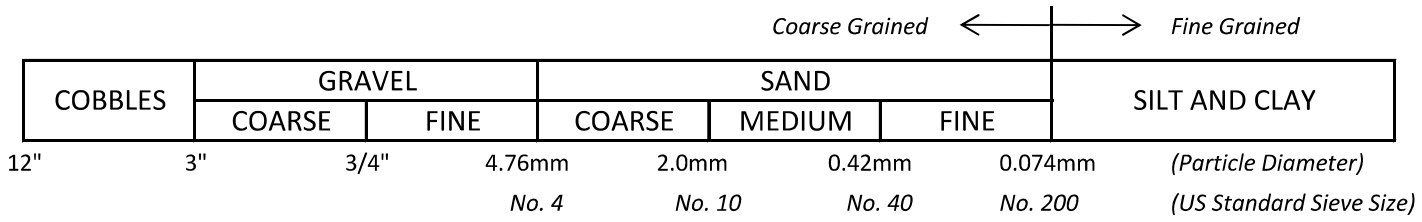
Driller:	L.S.
Hammer Type:	Automatic
Rig Type	CME55
Drilling Method	SPT

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(561) 419-8460

SPT Split Spoon Sampler
Groundwater at Time of Drilling
WOH= Weight of Hammer

USCS SOIL CLASSIFICATION GUIDANCE & SOIL DESCRIPTION INFORMATION

PARTICLE SIZES



Greater than 50% material (by weight) passing the US No. 200 Sieve = Fine Grained Soil (silt or clay)
Greater than 50% material (by weight) retained on the US No. 200 Sieve = Coarse Grained Soil (sand or gravel)

MODIFIERS

Based on Visual & Tactile Estimates (unless specific lab testing data is provided)

Estimates of Fines Content (Percent Passing US No. 200 Sieve)

FINES CONTENT	MODIFIERS	USCS SYMBOLS
0 to 5%	No Modifiers Used	SP, SW, GP, GW
5 to 12%	SLIGHTLY SILTY or SLIGHTLY CLAYEY	SP-SM, SP-SC
12 to 35%	SILTY or CLAYEY	SM, SC
35 to 45%	VERY SILTY or VERY CLAYEY	SM, SC
45 to 55%	Use Dual (e.g. CLAYEY SAND/SANDY CLAY)	SC/CL or SM/ML

Estimates of Organic Content (by weight)

ORGANIC CONTENT	MODIFIERS
1 to 3%	Trace Organics
3 to 10%	Slightly Organic
10 to 30%	Organic
> 30%	Highly Organic or Peat

Estimates of Other Materials
(e.g. shell, rock, phosphate, etc.)

OTHER MATERIALS	MODIFIERS
1 to 5%	Trace
5 to 12%	Some
> 12%	Abundant
> 15% sand or gravel	With sand or With gravel

CORRELATION OF "SPT N" WITH RELATIVE DENSITY AND CONSISTENCY

COARSE GRAINED SOILS		
SPT N		
Auto	Safety	RELATIVE DENSITY
< 3	< 4	VERY LOOSE
3 - 8	4 - 10	LOOSE
9 - 24	11 - 30	MEDIUM DENSE
25 - 40	31 - 50	DENSE
41 +	51 +	VERY DENSE

FINE GRAINED SOILS		
SPT N		
Auto	Safety	CONSISTENCY
< 1	< 2	VERY SOFT
1 - 3	2 - 4	SOFT
4 - 6	5 - 8	FIRM
7 - 12	9 - 15	STIFF
13 - 24	16 - 30	VERY STIFF
25 +	31 +	HARD

HB ESTIMATING REC'D 06.01.2026

PACIFICA ENGINEERING SERVICES

Pacifica Engineering Services

601 N.Congress Avenue, Suite 303, Delray Beach, Florida 33445

Percolation Test

Client	**Hedrick Brothers**	Boring No.	**B-1**
Project	MCSD Murray Middle School Modernization	Date Started	1/27/2026
Boring Location	See Boring Location Plan	Date Completed	1/27/2026
Elev. Ref.	N/A	PACIFICA Proj. No.	320-26632
Remarks			

Subsurface Profile	
Depth (ft)	**Soil Description**
0-2	3" Topsoil / Brown Fine SAND
2-10	Brown Fine SAND with Few to Trace Organics and Silt

Percolation Results

Diameter		Depth of Hole (ft)	Depth of Groundwater Level Below Ground Surface (ft)		Hydraulic Head (ft)	Saturated Hole Depth (ft)	Average Flow Rate (gpm)	K, Hydraulic Conductivity cfs/ft^2-ft
Casing (in)	Perforated PVC (in)		Prior to Test	During Test				
3	2	10	7	0	7	3	0.9	8.4E-05

Note:

(1) The above hydraulic conductivity values are for a french drain installed to the same depth as the borehole tests. The values represent an ultimate value. The designer should apply the appropriate factor of safety.

(2) The hydraulic conductivity values were calculated based on the South Florida Water Management District's USUAL OPEN HOLE CONSTANT HEAD percolation test procedure as shown on the "Equations in SFWMD Permit Information Manual, Volume IV".

(3) A diameter of two inches was used in the computation of the Hydraulic Conductivity value presented in the above table.

Percolation Test

Client	**Hedrick Brothers**	Boring No.	**B-3**
Project	MCSD Murray Middle School Modernization	Date Started	1/27/2026
Boring Location	See Boring Location Plan	Date Completed	1/27/2026
Elev. Ref.	N/A	PACIFICA Proj. No.	320-26632
Remarks			

Subsurface Profile	
Depth (ft)	**Soil Description**
0-10	1" Asphalt / Gray to Brown Fine SAND

Percolation Results

Diameter		Depth of Hole (ft)	Depth of Groundwater Level Below Ground Surface (ft)		Hydraulic Head (ft)	Saturated Hole Depth (ft)	Average Flow Rate (gpm)	K, Hydraulic Conductivity cfs/ft^2-ft
Casing (in)	Perforated PVC (in)		Prior to Test	During Test				
3	2	10	6	0	6	4	0.8	8.1E-05

Note:

(1) The above hydraulic conductivity values are for a french drain installed to the same depth as the borehole tests. The values represent an ultimate value. The designer should apply the appropriate factor of safety.

(2) The hydraulic conductivity values were calculated based on the South Florida Water Management District's USUAL OPEN HOLE CONSTANT HEAD percolation test procedure as shown on the "Equations in SFWMD Permit Information Manual, Volume IV".

(3) A diameter of two inches was used in the computation of the Hydraulic Conductivity value presented in the above table.

Percolation Test

Client	**Hedrick Brothers**	Boring No.	**B-4**
Project	MCSD Murray Middle School Modernization	Date Started	1/27/2026
Boring Location	See Boring Location Plan	Date Completed	1/27/2026
Elev. Ref.	N/A	PACIFICA Proj. No.	320-26632
Remarks			

Subsurface Profile	
Depth (ft)	**Soil Description**
0-2	1" Asphalt /Gray to Brown Fine SAND with Few Limerock
0-10	Gray to Brown Fine SAND

Percolation Results

Diameter		Depth of Hole (ft)	Depth of Groundwater Level Below Ground Surface (ft)		Hydraulic Head (ft)	Saturated Hole Depth (ft)	Average Flow Rate (gpm)	K, Hydraulic Conductivity cfs/ft^2-ft
Casing (in)	Perforated PVC (in)		Prior to Test	During Test				
3	2	10	6	0	6	4	0.9	9.1E-05

Note:

(1) The above hydraulic conductivity values are for a french drain installed to the same depth as the borehole tests. The values represent an ultimate value. The designer should apply the appropriate factor of safety.

(2) The hydraulic conductivity values were calculated based on the South Florida Water Management District's USUAL OPEN HOLE CONSTANT HEAD percolation test procedure as shown on the "Equations in SFWMD Permit Information Manual, Volume IV".

(3) A diameter of two inches was used in the computation of the Hydraulic Conductivity value presented in the above table.

Percolation Test

Client	**Hedrick Brothers**	Boring No.	**B-8**
Project	MCSD Murray Middle School Modernization	Date Started	1/29/2026
Boring Location	See Boring Location Plan	Date Completed	1/29/2026
Elev. Ref.	N/A	PACIFICA Proj. No.	320-26632
Remarks			

Subsurface Profile	
Depth (ft)	**Soil Description**
0-10	3" Topsoil / Gray to Brown Fine SAND

Percolation Results

Diameter		Depth of Hole (ft)	Depth of Groundwater Level Below Ground Surface (ft)		Hydraulic Head (ft)	Saturated Hole Depth (ft)	Average Flow Rate (gpm)	K, Hydraulic Conductivity cfs/ft^2-ft
Casing (in)	Perforated PVC (in)		Prior to Test	During Test				
3	2	10	7	0	7	3	0.9	8.4E-05

Note:

(1) The above hydraulic conductivity values are for a french drain installed to the same depth as the borehole tests. The values represent an ultimate value. The designer should apply the appropriate factor of safety.

(2) The hydraulic conductivity values were calculated based on the South Florida Water Management District's USUAL OPEN HOLE CONSTANT HEAD percolation test procedure as shown on the "Equations in SFWMD Permit Information Manual, Volume IV".

(3) A diameter of two inches was used in the computation of the Hydraulic Conductivity value presented in the above table.

Percolation Test

Client	**Hedrick Brothers**	Boring No.	**B-9**
Project	MCSD Murray Middle School Modernization	Date Started	1/27/2026
Boring Location	See Boring Location Plan	Date Completed	1/27/2026
Elev. Ref.	N/A	PACIFICA Proj. No.	320-26632
Remarks			

Subsurface Profile	
Depth (ft)	**Soil Description**
0-10	3" Topsoil / Brown Fine SAND

Percolation Results

Diameter		Depth of Hole (ft)	Depth of Groundwater Level Below Ground Surface (ft)		Hydraulic Head (ft)	Saturated Hole Depth (ft)	Average Flow Rate (gpm)	K, Hydraulic Conductivity cfs/ft^2-ft
Casing (in)	Perforated PVC (in)		Prior to Test	During Test				
3	2	10	4	0	4	6	0.8	1.1E-04

Note:

(1) The above hydraulic conductivity values are for a french drain installed to the same depth as the borehole tests. The values represent an ultimate value. The designer should apply the appropriate factor of safety.

(2) The hydraulic conductivity values were calculated based on the South Florida Water Management District's USUAL OPEN HOLE CONSTANT HEAD percolation test procedure as shown on the "Equations in SFWMD Permit Information Manual, Volume IV".

(3) A diameter of two inches was used in the computation of the Hydraulic Conductivity value presented in the above table.

Summary of Laboratory Test Results

MCSD Murray Middle School Modernization

PACIFICA ENGINEERING SERVICES

PACIFICA Project No.: 320-26632

Boring Number	Sample Depth (ft)	USCS Classification	Fines Content (%)	Organic Content (%)	Natural Moisture Content (%)
B-1	4-6	SP-SM	11.2	6.9	19.5
B-6	6-8	SP-SM		6.3	22.2
B-15	4-6	SP-SM		9.1	24.5

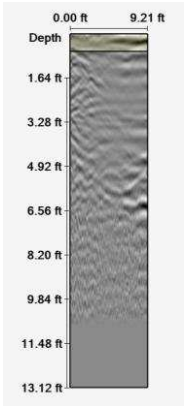
HB ESTIMATING REC'D 06.01.2026

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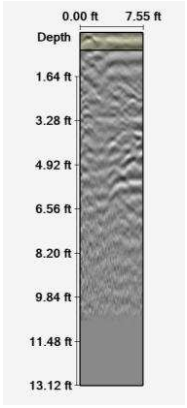
GROUND PENETRATING RADAR (GPR) SCANNING DOCUMENTATION



B-1 West to East Scan



B-1 South to North Scan



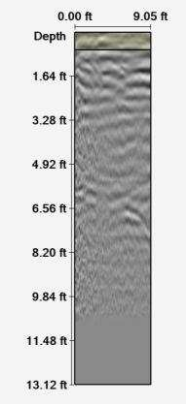
GEOTECHNICAL ENGINEERING SERVICES MCSD Murray Middle School Modernization 4400 SE Murray Street, Stuart, Florida		DATE: 02/04/2025 DRAWN: KN
SHEET NO.: 1	PACIFICA PROJ. NO: 320-26632	CHKD: AK

PACIFICA ENGINEERING SERVICES

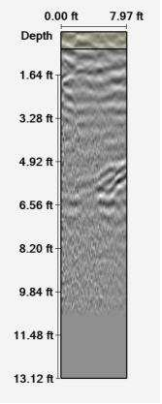
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B-2 West to East Scan



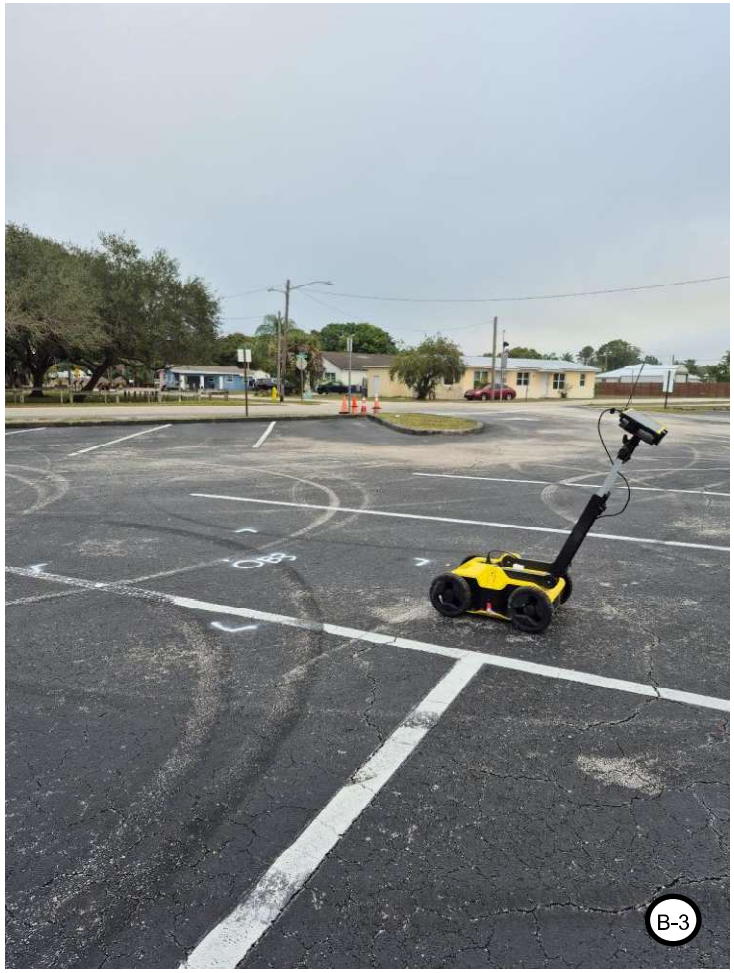
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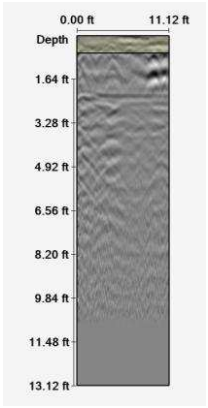
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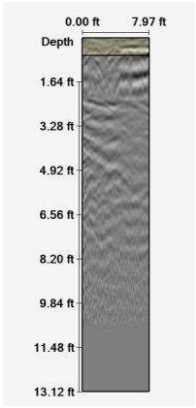
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B-3 West to East Scan



B-3 South to North Scan



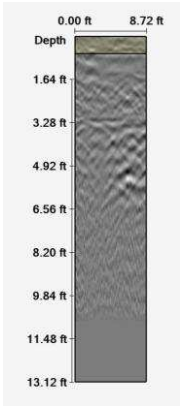
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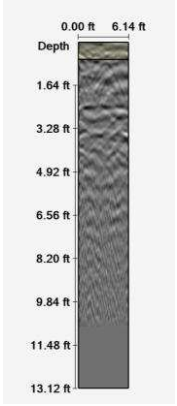
GROUND PENETRATING RADAR (GPR) SCANNING DOCUMENTATION



B-4 West to East Scan



B-4 South to North Scan



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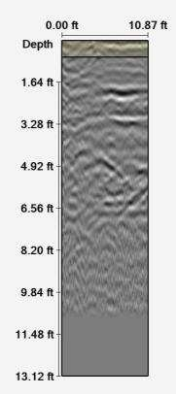
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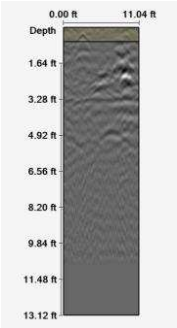
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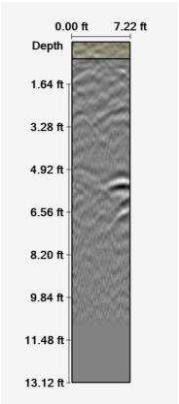
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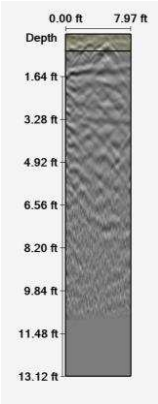
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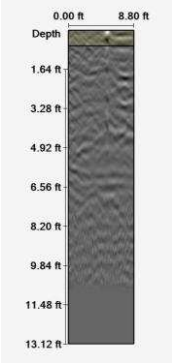
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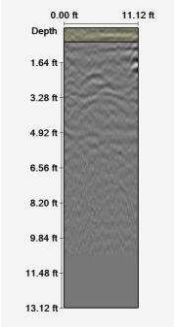
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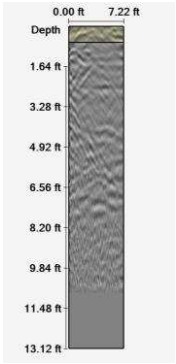
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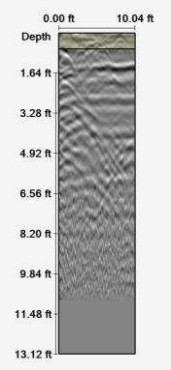
B-6 South to North Scan



B-7 South to North Scan



B-8 South to North Scan



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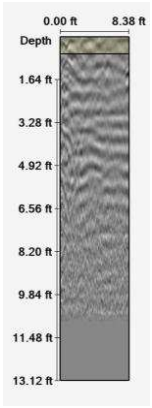
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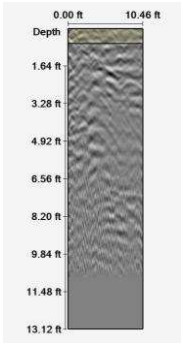
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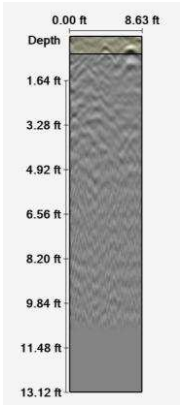
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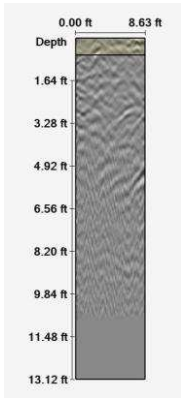
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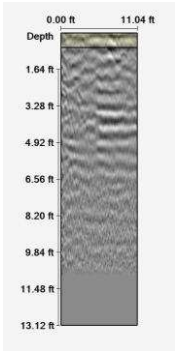
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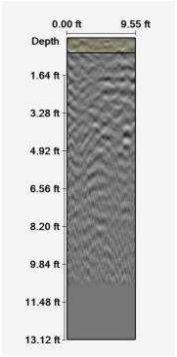
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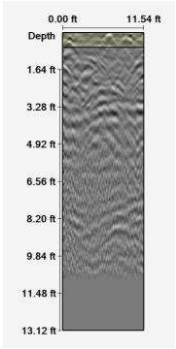
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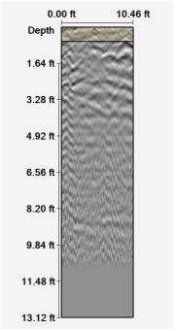
B-10 South to North Scan



B-11 South to North Scan



B-12 South to North Scan



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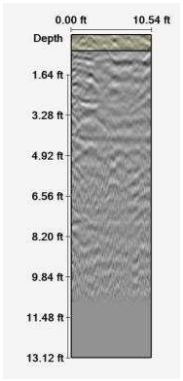
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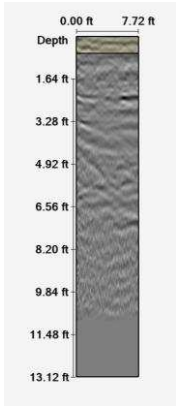
PACIFICA ENGINEERING SERVICES

GROUND PENETRATING RADAR (GPR) SCANNING DOCUMENTATION

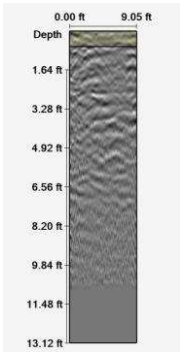
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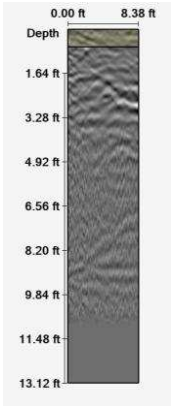
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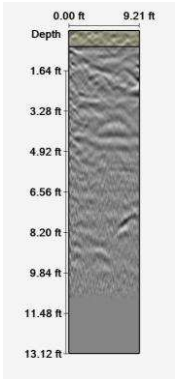
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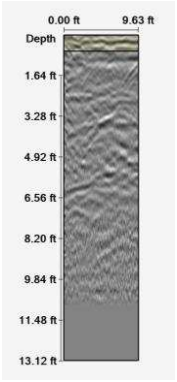
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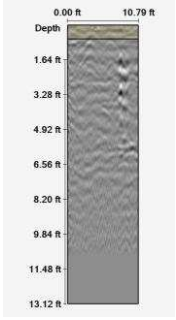
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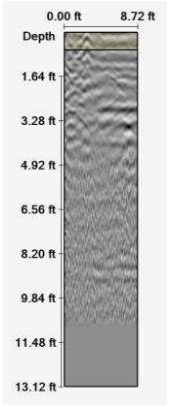
B-14 South to North Scan



B-15 South to North Scan



B-16 South to North Scan



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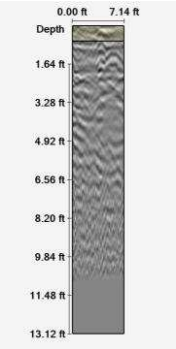
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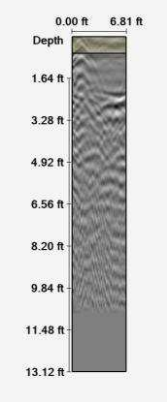
PACIFICA ENGINEERING SERVICES

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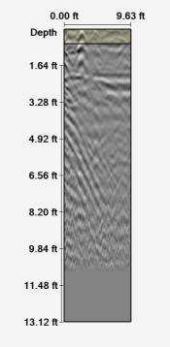
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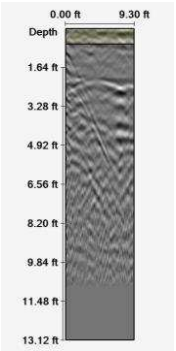
B-18 West to East Scan



B-17 South to North Scan



B-18 South to North Scan



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DRAWN: KN

SHEET NO.: 8

PACIFICA PROJ. NO: 320-26632

CHKD: AK

PACIFICA ENGINEERING SERVICES

SECTION 01 10 00 - SUMMARY

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Requirements including, but not limited to:
   1. Project information.
   2. Work covered by Contract Documents.
   3. Owner-furnished Construction Manager installed products.
   4. Type of Contract.
   5. Work by Owner and under separate contracts.
   6. Access to site.
   7. Coordination with occupants.
   8. Work restrictions.
   9. Construction and sequencing scheduling.
   10. Protection of work and adjacent property.
   11. Owner occupancy.
   12. Specification and Drawing conventions.
   13. Construction Schedule.

1.3 PROJECT INFORMATION

A. Project Name: Murray Middle School Modernization

B. Project Location:
   4400 SE Murray Street
   Stuart, Florida 34997

C. Owner: Martin County School District

D. Architect: PBK Architects Florida, Inc.

E. Consultants:
   1. Civil Engineer:
      Kilma Weeks Civil Engineering, Inc.
      495 Montgomery Place, Altamonte Springs, FL 32714
   2. Structural Engineer:
      Master Consulting Engineers, Inc.
      4101 Ravenswood Road, Suite 320, Fort Lauderdale, FL 33312
   3. Mechanical / Electrical / Plumbing Engineer:
      JLRD Consulting Engineers
      1450 Centrepark Blvd., Suite 350, West Palm Beach, FL 33401
   4. Envelope Consultant:
      BEAM Professionals
      2407 Vista Parkway, Suite 100, West Palm Beach, FL 33411
   5. Landscape Architect:
      Bortak Design
      1 SE Ocean Blvd, Stuart, FL 34994
   6. Geotechnical Consultant:
      Pacifica Engineering Services, LLC. (PACIFICA)
      601 North Congress Ave., Suite 303, Delray Beach, FL 33445

HB ESTIMATING REC'D 06.01.2026

7. Contractor / Construction Manager:
   Hedrick Brothers Construction
   2200 Centrepark W. Drive, West Palm Beach, FL 33409

F. Project Description: This project consists of the demolition of three existing classroom buildings (Building #9, #10, and #18), the existing administration building (Building #5), and the existing parent parking area with pick-up/drop-off loop. New Construction includes a new parent parking area with pick-up/drop-off loop, and a new two-story classroom building with administrative offices (Building #01). Renovations of existing space includes alterations to the interior of the existing gymnasium (Building #6).

1.4 WORK COVERED BY THE CONTRACT DOCUMENTS

A. Contract Documents: Contract documents are defined in the General Conditions of the Contract, and include the following:
   1. Drawings as listed on Index.
   2. Specification Sections as listed on Table of Contents in Project Manual.
   3. All addenda issued prior to Bid Opening

1.5 PURCHASE CONTRACTS

A. General: Owner has negotiated purchase contracts with suppliers of material and equipment to be incorporated into the Work. Owner will assign these purchase contracts to Construction Manager. Include costs for purchasing, receiving, handling, storage if required, and installation of material and equipment in the Contract Sum, unless otherwise indicated.
   1. Construction Manager’s responsibilities are same as if Construction Manager had negotiated purchase contracts, including responsibility to renegotiate purchase and to execute final purchasing agreements.

1.6 OWNER-FURNISHED CONSTRUCTION MANAGER INSTALLED PRODUCTS

A. Owner will furnish products indicated to be installed by the Construction Manager. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner-furnished products.

B. Owner will furnish products indicated. The Work includes providing support systems to receive Owner's equipment and making plumbing, mechanical, and electrical connections.
   1. Owner will arrange for and deliver Shop Drawings, Product Data, and Samples to Contractor.
   2. Owner will arrange and pay for delivery of Owner-furnished items according to Contractor's Construction Schedule.
   3. After delivery, Owner will inspect delivered items for damage. Construction Manager shall be present for and assist in Owner's inspection.
   4. If Owner-furnished items are damaged, defective, or missing, Owner will arrange for replacement.
   5. Owner will furnish Construction Manager the earliest possible delivery date for Owner-furnished products. Using Owner-furnished earliest possible delivery dates, Construction Manager shall designate delivery dates of Owner-furnished items in Construction Manager 's Construction Schedule.
   6. Construction Manager is responsible for receiving, unloading, and handling Owner-furnished items at Project site.
   7. Construction Manager is responsible for protecting Owner-furnished items from damage during storage and handling, including damage from exposure to the elements.
   8. If Owner-furnished items are damaged as a result of Construction Manager 's operations, Construction Manager shall repair or replace them.
   9. Construction Manager shall install and otherwise incorporate Owner-furnished items into the Work.
   10. A schedule of owner furnished items is included on the drawings.

C. Owner-Furnished Products:

HB ESTIMATING REC'D 06.01.2026

1. See drawings for list ofOwner-Furnished products.

1.7 TYPE OF CONTRACT

A. Project will be constructed under a Construction Manager at Risk (CMAR) contract.

1.8 WORK BY OWNER AND UNDER SEPARATE CONTRACTS

A. Cooperate fully with Owner so Work may be carried out smoothly, without interfering with or delaying the work or work by Owner. Coordinate the Work with Work performed by Owner.

B. Owner reserves the right to let separate contract for Work outside of the scope of this Contract. Cooperate fully with separate contractors so Work on those contracts may be carried out smoothly, without interfering with or delaying Work under this Contract or other contracts. Coordinate the Work of this Contract with Work performed under separate contracts.

C. Purchase Contracts: Owner reserves the right to negotiate purchase contracts with suppliers of material and equipment that may be incorporated into the Work. Owner will assign these purchase contracts to Construction Manager. Include costs for purchasing, receiving, handling, storage if required, and installation of material and equipment in the Contract Sum, unless otherwise indicated.
   1. Construction Manager's responsibilities are same as if Construction Manager had negotiated purchase contracts, including responsibility to renegotiate purchase and to execute final purchasing agreements.

D. Owner-Furnished, Contractor-Installed Products (OFCI): Owner will furnish products indicated. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner furnished products and making building services connections when applicable.

E. Owner Furnished Products: Coordinate with Owner.

1.9 ACCESS TO SITE

A. General: Construction Manager shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

B. Use of Site: Limit use of Project site to Work in areas and areas within the Contract limits indicated. Do not disturb portions of site beyond areas in which the Work is indicated.
   1. Limits:
      a. Drawings indicate the limits of the construction operations.
      b. Limit site disturbance, including earthwork and clearing of vegetation, to 40 feet (12.2 m) beyond building perimeter; 10 feet (3 m) beyond surface walkways, patios, surface parking, and utilities less than 12 inches (300 mm) in diameter; 15 feet (4.5 m) beyond primary roadway curbs and main utility branch trenches; and 25 feet (7.6 m) beyond constructed areas with permeable surfaces (such as pervious paving areas, stormwater detention facilities, and playing fields) that require additional staging areas in order to limit compaction in the constructed area.
   2. Driveways, Walkways, and Entrances: Keep driveways, parking areas, drop off points, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, students, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
      a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
      b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

C. Construction access path, contractor parking area(s), dumpster locations, temporary office location, and material storage/staging areas are to be provided as indicated on the construction drawings or if not shown, shall be approved by the Facilities Operations Representative with input from the School staff in advance of starting work. Construction access and facilities may not adversely impact school operations.

HB ESTIMATING REC'D 06.01.2026

D. Condition of Existing Building: Maintain portions of existing building affected by construction operations in weathertight condition throughout construction period. Repair damage caused by construction operations.

1.10 COORDINATION WITH OCCUPANTS

A. Full Owner Occupancy: Owner will occupy site and adjacent building(s) during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform Work to prevent interference with Owner's day to day operations. Maintain existing exits unless otherwise indicated.
   1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
   2. Notify Owner not less than 72 hours in advance of activities that will affect Owner's operations.

B. Limited Owner Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.
   1. Architect shall prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.
   2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
   3. Before limited Owner occupancy, ensure mechanical and electrical systems are fully operational, and required tests and inspections and start up procedures are successfully completed. On occupancy, Owner shall operate and maintain mechanical and electrical systems serving occupied portions of Work.
   4. Upon occupancy, Owner shall assume responsibility for maintenance and custodial service for occupied portions of Work.

1.11 WORK RESTRICTIONS

A. Work Restrictions: Comply with restrictions on construction operations. Comply with limitations on use of public streets and with other requirements of Authority Having Jurisdiction.

B. The School District publishes bell times and school holidays on its web site. The Contractor must plan the work to avoid disrupting the District’s mission of teaching and learning. The Contractor shall schedule the work with the input of the site administrator and the Owner’s project representative and shall ensure that work activities coincide with the school’s schedule, including all after-hours or extra-curricular events. The District acknowledges that some activities may take place during the normal school day which are not disruptive to teaching and learning, and which shall be approved in advance by the Facilities Operations Representative. The Contractor understands that he may be asked to stop any work activity during the normal school day if the activity proves to be a nuisance.
   1. Disruptive activities include those which generate odor, vibration, dust or noise which can be heard in adjacent buildings.

C. On-Site Work Hours: Limit Work in the existing building to normal working hours, Monday through Friday, unless otherwise indicated. Coordinate with Owner when it is necessary to extend working hours or Work on weekends.

D. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and after providing temporary utility services according to requirements indicated:
   1. Notify Owner not less than two weeks in advance of proposed utility interruptions.
   2. Obtain Owner’s written permission before proceeding with utility interruptions.

E. Work and storage areas are to be fenced with 6' high temporary chain link fencing unless otherwise noted on these plans or approved in writing, in advance of construction. Temporary fencing and barricades are to be maintained through substantial completion. The Contractor is responsible to ensure that the work area is secure, and to ensure the safety of students and staff.

F. Provide a written request a minimum of eight (8) business days in advance when the work may impact occupancy and use of any facility, including systems noted above.

G. Work may not be performed, and materials may not be delivered to the job site during times when the Construction Superintendent is not on site. The Construction Superintendent is defined as a direct employee of the Contractor. This role may not be delegated to a subcontractor.

H. Security Procedures
   1. Construction Workers and delivery personnel are prohibited from communicating with staff and students at the job site. All communication is to be routed to the Design Professional or the Facilities Operations Representative. In the event of an emergency at the job site, the jobsite superintendent is to communicate the concern to the Site Administrator, and immediately contact the Facilities Operations Representative and Design Professional.
   2. Contractor/CM to develop site security program, project entry control procedures, and personnel screening and identification in compliance with Florida Statute FS1012.465 – Jessica Lunsford Act for vendors, and Contractor/CM's.
   3. Jessica Lunsford Act:
      a. Contractor/CM, his subcontractors, vendors and suppliers who are to be permitted access to school grounds while students are present, or have direct contact with students or have access to or control of school funds shall obtain Level 2 background screening in accord with Florida Statute FS1012.465 – Jessica Lunsford Act.
      b. Level 2 screening excludes personnel working on school district property where students are present who have criminal records that include sexual offender, sexual misconduct with developmentally disabled or mental heath patients, terrorism, murder, kidnapping, lewd, lascivious or indecent acts or exposure, incest, child abuse or neglect.
      c. Persons screened as noted above with other types of criminal history may be allowed on school grounds provided under following conditions:
         1) Contractor/CM, subcontractors, vendors and suppliers shall be under continuous direct supervision of school district employee or Level 2 screened and cleared employee as noted above.
         2) Contractor/CM, subcontractors, vendors and suppliers may be allowed on a student occupied site if area of construction is isolated from students by continuous six foot high chain link fence separating work area and school.
         3) Persons with current Level 2 clearance who are subsequently arrested for disqualifying offenses shall be disqualified from access to school sites and shall immediately surrender their Photo ID Badge to their employer who shall be responsible for returning badge to Martin County School District's Department of Human Resources with 48 hours of arrest or notice of arrest or criminal offense.
         4) Persons failing to notify their employer and Martin County School District's Department of Human Resources with 48 hours of arrest will be charged with 3rd degree felony, punishable by up to five years imprisonment and $1,000 fine.
         5) Employers of persons having been arrested for disqualifying offenses who subsequently allows said employee to continue working on school property may also be charged with 3rd degree felony, punishable by up to five years imprisonment and $1,000 fine.
      d. Contractor/CM, his subcontractors, vendors and suppliers working on school board sites shall be fingerprinted and obtain work badges.
         1) Contractor/CM, his subcontractors, vendors and suppliers have worked and obtained in other school districts must be screened to obtain new badges.

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2) Questions regarding fingerprinting or identification badge processing may be directed to District Personnel Department at (772)219-1200, Ext. 30296.
3) Fingerprinting services are provided by private vendor through Florida Dept. of Education. DOE sponsored website will direct individuals to nearest fingerprinting location.

e. Cost of fingerprinting is (Check with the School District) per person and shall be prepaid either by money order to (Check with the School District) or by credit card payment via Internet. Website is http://www.flprints.com. For information, telephone (877) 357-7456.
f. Money orders shall be made out to 3M Cogent. Money order must be brought to appointment.
g. Individuals shall register online prior to their appointment:
1) Navigate to https://www.cogentid.com/fl/index_fdoe.htm and select “register online”.
2) For County select Martin County from pull-down box.
3) For CRI Literal select: FL931392Z Contractors & Vendors.
4) Fill out remaining information and submit.
5) Use Internet Explorer.
h. Individuals being fingerprinted shall provide valid, government issued driver’s license, identification card or passport.
i. After fingerprinting and criminal background check is complete, individuals shall make appointment for photo ID’s by making appointments at Martin County School District Personnel Department located in Building 20 at School District Administration Center, 500
j. E. Ocean Blvd., Stuart, FL 34994.
k. Appointments for ID photo badges shall be made after completion of fingerprinting with. Martin County School District Personnel Department by phone at (772) 219-1200, Ext. 30296
l. Photo ID applicants shall have registration confirmation receipt with them when they arrive for appointment.
m. Cost of Photo ID’s is (Check with the School District). Payment may be made with company check, money order or personal check. Checks shall be made payable to Martin County School District.
n. Non-Instructional Contractors with current Martin County School District ID Photo Badges shall update their badges to the State Uniform Badge required by Florida Statute 1012.467, effective July 1, 2014.
1) There is no cost for individuals with current Martin County School District ID Photo Badges to upgrade their badges.
2) Badges from other individual School Districts are no longer accepted on school sites in Florida.
3) New state wide badges are accepted in any School District regardless of where it was issued.
4) Non-Instructional Contractors and their employees working on School sites shall apply for State-Wide Badges as noted above.
5) Non-Instructional Contractors shall submit lists of their badged employees via email to Eileen Loreti at the Martin County School District Personnel Department at loretie@martin.k12.fl.us.

4. Security Program:
a. Protect new work, existing facilities and grounds from damage, theft, vandalism, and unauthorized entry.
b. Initiate security program in coordination with Owner's existing security system at time of project mobilization to ensure safety of students, faculty and visitors to the unaffected portions of the school facilities.

c. No student contact is permitted between the Contractor's personnel and students. Any breach of this requirement will result in the immediate removal of the personnel from the job site upon direction by the Owner.
d. Smoking is not allowed on School Board property. Any breach of this restriction will result in immediate removal of personnel from the site upon direction by Owner's Project Manager.
e. Maintain security program throughout construction period until Owner's project acceptance.

5. Entry Control:
   a. Restrict entrance of persons and vehicles into Project site and existing facilities as indicated by Owner approved security plan.
   b. Allow entrance only to authorized persons with proper identification.
   c. Maintain log of workers and visitors, make available to Owner on request.
   d. Coordinate access of Owner's personnel to site in coordination with Owner's security forces.
6. Personnel Identification:
   a. Contractor/CM on-site staff, subcontractors and vendors on site shall wear identification badges at all times on site.
   b. Identification badges shall be current at time of project and shall be reverified and reissued yearly if project extends past original badge expiration date.
   c. Provide list of personnel proposed to be used on project for fingerprinting and background checks (only required for existing school projects).
   d. Contractor/CM shall submit initial list of accredited persons and provide monthly updated lists to Owner.
7. Provide security plan to Owner indicating how construction site is to be secured and separated from existing school and its operations including normal and emergency egress and exiting from the operational portion of school and for new additions and existing portion under construction.

I. Where temporary barriers and partitions are shown separating the work area from the occupied areas of the building, they are to be constructed using nominal 2x4 wood studs with ½" plywood or ½" gypsum wallboard on the occupied side.

J. Work limits and phasing of the Work, if applicable, is shown on the Drawings. Where multiple phases are required, the Contractor is required to achieve substantial completion of the preceding phase prior to beginning the next phase unless otherwise noted. Work areas are to be secured at the end of each work day and made safe for occupancy prior to the next school day.

K. Noise, Vibration, and Odors: Coordinate operations that result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
   1. Notify Owner not less than two weeks in advance of proposed disruptive operations.
   2. Obtain Owner's written permission before proceeding with disruptive operations.

L. Any work that must be done outside of the designated construction area or phase limit in order to accomplish the Work of the project or phase of the project must have prior written approval from the Owner's project representative and must be scheduled so as to avoid disrupting the Owner's operations.

M. Controlled Substances, Firearms, and Explosive Devices: Use of tobacco products, controlled substances, firearms, and explosive devices on the site is not permitted.

N. Employee Identification: Provide identification tags for Construction Manager personnel working on site. Require personnel to use identification tags at all times.

O. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on site.
   1. Maintain list of approved screened personnel with Owner.

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1.12 DELIVERY AND RECEIVING

A. Packaging and Transportation:
   1. Supplier shall package finished products in boxes or crates to provide protection during shipment, handling and storage at site.
   2. Products shall be protected against exposure to outside storage against damage due to weather conditions.
   3. Protect products sensitive to damage against impact, abrasion, puncture and other damage during handling and transport to project.

B. Arrange deliveries of products in accord with project schedule to allow installation and project completion per approved project schedule.

C. Prior to project commencement, Contractor’s personnel shall meet with Owner’s Project Manager and School staff for renovation and new construction to delineate areas for materials storage lay-down areas.

D. Restrict access of persons to storage areas in accordance with Security Procedures listed in paragraph "Security Procedures" above.

E. Material deliveries to Owner occupied sites shall be coordinated with Owner’s Project Manager to ensure availability of personnel and handling equipment for safe and secure unloading and storage of equipment.

F. Deliver products in undamaged, dry condition, in original unopened containers or packaging with identifying labels intact and legible.

G. Clearly mark partial deliveries of component parts of equipment to identify equipment and contents, to permit easy accumulation of parts, and to facilitate assembly.

H. Upon delivery, Contractor/CM shall inspect shipments for following items:
   1. Products received match reviewed submittals and Contract Documents.
   2. Correct quantities.
   3. Accessories and installation hardware are included.
   4. Containers and packages are intact and labels are legible.
   5. Products are adequately protected for conditions and are undamaged.

I. Product Handling:
   1. Provide equipment and personnel to handle products to prevent product damage.
   2. Handle products to avoid bending, flexing or overstressing.
   3. Lift large or heavy components by using designated lifting points in accord with manufacturers written directions.

1.13 CONSTRUCTION AND SEQUENCE SCHEDULING

A. Generally, in order to accommodate the uninterrupted operation of the existing facility during the various phases of construction, the sequence of construction operations shall be as follows:
   1. Make necessary provisions to allow the occupied portions of the facility to function during construction, including provisions for temporary utilities, temporary walkways, erection of temporary barricades and fencing, and the like.
   2. Complete and turn over for occupancy the project or portions of the project, as phased. Unless otherwise specified or specifically approved during construction, work of subsequent phases cannot begin prior to substantial completion of the previous phase.
   3. Upon final completion, Owner acceptance of the project.

B. Some overlapping of construction operations may occur, and where necessary the Contractor may request permission to start certain portions of the work before the previous operations are completed in their entirety. Such detailed scheduling shall be done as the work progresses, provided that the Owner’s operations remain uninterrupted, but in all cases must receive Owner approval.

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C. Where it is not possible to complete certain mechanical and electrical services to make the work complete and ready for occupancy, temporary services may be approved to permit occupancy by the Owner at the earliest possible date.

D. Detailed construction scheduling is the responsibility of the Contractor.

1.14 PROTECTION OF WORK AND ADJACENT PROPERTY

A. Buildings and adjacent areas may be subject to damage due to construction operations. At the Completion of the project, the Contractor shall restore existing buildings, landscaping, turf, parking facilities, sidewalks, etc., to the same or better condition as prior to the start of the work.

B. In addition to requirements of the General Conditions of the Contract for Construction, the Contractor shall:
   1. Notify, in writing, the Facilities Operations Representative when equipment or property interferes with the Work and arrange for disposition of such property.
   2. Provide coverings over inlets, area drains, drywells, etc. to prevent soil and construction debris from running into the storm system. In the event of a failure of a covering, the Contractor is required to clean the affected piping and structure(s) prior to substantial completion.
   3. Provide protection from rain, wind, and extreme temperatures to protect new work, materials, equipment, fixtures and adjacent areas from damage.
   4. Provide protection against stormwater back-ups when the storm system is affected by the work. Maintain flows as needed to avoid damage to the work and to surrounding areas.
   5. Provide temporary protection around openings through and at floors, roofs and other openings.
   6. Per the Florida Trench Safety Act (ss. 553.60-553.64): Provide and maintain proper shoring and bracing for excavations to prevent collapse or other damage until they can be properly backfilled upon completion of the new work.

C. The Contractor is required to photograph existing conditions related to existing conditions and to provide photographs in electronic format to the Design Professional and Facilities Operations Representative a minimum of 7 days prior to starting work on site. Sufficient photos with adequate detail to thoroughly document existing conditions shall be provided.

1.15 OWNER OCCUPANCY

A. The Owner reserves the right to occupy and to install equipment in completed areas of the building prior to Substantial completion, provided that such occupancy does not interfere with completion of the work. Such occupancy shall not constitute acceptance of the work.

B. Upon Substantial Completion of the project or portions thereof, the Owner will take occupancy. The Contractor is required to adjust work hours as needed in occupied areas so as to avoid disrupting Owners operations.
   1. Access to the facility and work area will be controlled by the Owner beginning at Substantial Completion. Refer also to the Close Out Procedures section.

1.16 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: Specifications use certain conventions for style of language and intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
   1. Imperative mood and streamlined language are generally used in Specifications. The words "shall," "shall be," or "shall comply with," depending on context, are implied where a colon (:) is used within a sentence or phrase.
   2. Specification requirements are to be performed by Construction Manager unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of each Specification section.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in Specifications. One or more of the following are used on Drawings to identify materials and products:
   1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
   2. Abbreviations: Materials and products are identified by abbreviations.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 CONSTRUCTION SCHEDULE

A. Owner has a critical need for the Work to begin upon Notice to Proceed and shall be Substantially Complete by as agreed to in the Contract. There will be no Extensions of Time due to weather except in cases of extreme weather (hurricane, tornado, etc.). The impact of each extreme weather event on schedule shall be discussed by the Architect, Owner, and Construction Manager.

END OF SECTION

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SECTION 01410- MATERIALS TESTING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Special Conditions and other Division-f Specification Sections, apply to this Section.-

1.2 PROCEDURE

A. Testing Agency: An independent testing agency shall be provided by the **CONSTRUCTION MANAGER (CM)** to inspect and test the materials and methods of construction as specified for compliance with the specification requirements of the Contract Documents.

1.3 QUALIFICATIONS OF TESTING AGENCY

A. The Testing Agency selected shall meet the basic requirements of ASTM E329 "Standard of Recommended Practice for Inspection and Testing Agencies for Concrete and Steel as Used in Construction."

B. The Testing Agency selected shall meet "Recommended Requirements for Independent Laboratory Qualification," latest edition, as published by the American Council of Independent Laboratories.

C. Testing machines shall be calibrated at intervals not exceeding 12 months by devices of accuracy traceable to the National Bureau of Standards or accepted values of natural physical constants.

D. Tests and inspection shall be conducted in accordance with specified requirements, and if not specified, in accordance with the applicable standards of the American Society for Testing and Materials or other recognized and accepted authorities in the field.

1.4 AUTHORITIES AND DUTIES OF THE TESTING AGENCY

A. Reviewing Drawings and Specifications: The Testing Agency shall obtain and review the project plans and specifications. The Agency shall attend site meetings to coordinate materials inspection and testing requirements with the planned construction schedule.

B. Notification of Deficiencies in the Work: The agency shall notify the Project Manager, Professional and CM first by telephone and then in writing of observed irregularities and deficiencies of the work and other conditions not in compliance with the requirements of the Contract Documents.

C. Reports: The agency shall send copies of test and inspection reports to the following parties:

1. 1 copy to the Project Manager or his representative
2. 3 copies to Professional
3. 1 copy to the Supplier of the material tested

D. Limitation of Authority: The Testing Agency is not authorized to revoke, alter, relax, enlarge upon, or release any requirements of the Specifications or to approve or accept any portion of the Work or to perform any construction work.

1.5 PAYMENT OF TESTING AGENCY

A. The CM shall pay for the Testing Agency services for testing of materials for compliance with the requirements of the Contract Documents. The CM shall also pay for testing and re-testing of materials that do not comply with the requirements of the Contract Documents and all other items as specified in these Specifications.

PART 2- PRODUCTS (NOT APPLICABLE)

PART 3- EXECUTION

3.1 SCOPE OF WORK

A. This Section specifies materials testing for earthwork, reinforcing steel, concrete, and steel. These tests must be provided by CM'S independent Testing Agency and be paid for by CM.

3.2 EARTHWORK

A. Quality Control Testing Required During Construction

1. Inspection of Subgrade and Fill: The Testing Agency shall inspect and approve the following subgrades and fill layers before further construction work is performed thereon:

   a. Building slab subgrade, Paved areas subgrade, and/or Foundation *wall* backfill: As recommended by the Geotechnical Report enclosed within the Specifications.

2. Field Density Tests: Field density tests shall be performed according to ASTM D1556 "Density of Soil in Place by the Sand Core Method," ASTM D2167 "Density of Soil in Place by the Rubber Balloon Method" or ASTM 02922 "Density of Soil and Soil Aggregate in Place by Nuclear Methods" as applicable.

3. Acceptance Criteria: The results of field density tests by the Testing Agency will be considered satisfactory if the average of any three consecutive tests has a value not greater than 2 percent below the required density.

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4. Report copies: The CM shall submit all results of field density tests certified by Testing Agency to the Project Manager and Professional.

5. Additional testing: If reports by the Testing Agency indicate field densities lower than specified above, additional tests will be run by the Testing Agency with at least the frequencies scheduled above on recompacted fill and/or natural subgrade. The costs of such test shall be borne by the CM.

B. Inspection by the Testing Agency: The CM shall provide a Testing Agency to perform inspection service for the following listed items prior *to* pouring and placing foundation concrete:

1. Spread (Dug) Footing Subgrade: Such inspection shall verify that field conditions are consistent with soil report test results and that the foundation is being installed in the proper soil strata at the proper elevation. The Testing Agency's written field inspection reports shall be submitted by CM to Professional and Project Manager.

3.3 REINFORCING STEEL

A. Visual Inspection: The Testing Agency shall inspect the reinforcing steel to determine the following:

1. The bars should be free from injurious defects and shall have a workman-like finish.
2. Deformations shall be of the proper sizes, shapes, and spacing as detailed in ASTM A-615.
3. The bars shall not have excessive rust and/or pelting.
4. The bars shall not have any unusual twists or bends

3.4 CONCRETE MATERIALS AND POURED IN PLACE CONCRETE A.

Concrete Mix Designs

1. The CM shall submit for approval concrete mix designs for each class of concrete indicated on the drawings and in the Specifications. The CM shall not begin work until the applicable mix design has been approved.

2. Required types of concrete and compressive strengths shall be indicated on the Drawings and Specifications.

3. Admixtures

a. Quantities of admixtures to be used shall be in strict accordance with the manufacturer's instructions.

b. Admixtures containing chloride ions shall not be used in pre-stressed concrete, in concrete containing galvanized or aluminum embedments, or in metal deck floors or roofs.

B. Concrete Test Cylinders by Testing Agency

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1. Molding and Testing: Cylinders for strength tests shall be molded and Laboratory cured in accordance with ASTM C31 "Method of Making and Curing Concrete Test Cylinders in the Field" and tested in accordance with ASTM C39 "Method of Testing for Compressive Strength of Cylindrical Concrete Specimens."

2. Field Samples: Field sample for strength tests shall be taken in accordance with ASTM C172 "Method of Sampling Fresh Concrete."

   a. Slump - ASTM C 143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.

   b. Air Content - ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231 pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete cured in accordance with ASTM C31 "Method of Making and Curing Concrete Test Cylinders in the Field" and tested in accordance with ASTM C39 "Method of Testing for Compressive Strength of Cylindrical Concrete Specimens."

2. Field Samples: Field sample for strength tests shall be taken in accordance with ASTM C172 "Method of Sampling Fresh Concrete."

   comply-with ASTM C

   a. Slump - ASTM C 143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.

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b. Air Content - ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231 pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.

c. Concrete Temperature- Test hourly when air temperature is 40 deg F (4 deg C) and below, when 80 deg F (27 deg C) and above, and each time a set of compression test specimens is made.

d. Compression Test Specimen- ASTM C 31; one set of 4 standard cylinders for each compressive strength test, unless otherwise directed. Mdd and store cylinders for laboratory-cured test specimens except when field-cure test specimens are required.

3. Compressive Strength Tests- ASTM C 39; one set for each day's pour exceeding 5 cu. yds. plus additional sets for each 50 cu. yds. more than the first 25 cu. yds. of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

4. When frequency of testing will provide fewer than 5 strength tests for a given class of concrete, conduct testing from at least 5 randomly selected batches or from each batch if fewer than 5 are used.

5. When total quantity of a given class of concrete is less than 50 cu. yds. Architect may waive strength test if adequate evidence of satisfactory strength is provided.

6. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.

7. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive strength by more than 500 psi.

8. Test results will be reported in writing to Architect, Structural Engineer, Ready-Mix Producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.

9. Nondestructive Testing -Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

10. Additional Tests- The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with

11. ASTM C 42, or by other methods as directed. Contractor shall pay for

such tests when unacceptable concrete is verified.

12. Transporting cylinders: The Testing Agency shall be responsible for transporting the cylinders to the laboratory in a. protected environment such that no damage or ill effect will occur to the concrete cylinders.

D. Investigation of Low Strength Concrete Test Results

1. Field tests: The Testing Agency shall perform nondestructive field tests of the concrete in question using appropriate methods and report the results in the same manner as for cylinder test reports.

2. Strengthening of the structure or demolition: if the structural adequacy of the affected portion of the structure remains in doubt, the CM strengthen the structure by appropriate means approved by the Professional or demolish and rebuild the structure.

3. Cost of investigations for low strength concrete: the costs of all investigations of low strength concrete shall be borne by the CM.

E. Job site inspection: Verify that all concrete being placed meets job specifications. Report concrete not meeting the specified requirements and immediately notify the owner.

F. Causes for rejection of concrete: The CM shall reject all concrete delivered to the site for any of the following reasons:

1. Wrong class of concrete (incorrect mix design number).
2. Concrete with temperatures exceeding 95°F may not be placed in the structure.
3. Slumps outside the limits specified in. the mix designs.
4. Excessive age. Concrete shall be discharged within 90 minutes of plant departure or before it begins to set if sooner than 90 minutes, unless approved by the laboratory job inspector or other duly appointed representative.

G. Concrete Batch Trip Tickets: All concrete batch trip tickets shall qe collected and retained by the CM. All tickets shall contain the information specified in ASTM C94. Each ticket shall also show the amount of water that may be added in the field for the entire batch that will not exceed the specified water cement ratio for the design mix.

3.5 MASONRY

A. Mortar Tests

1. Mortar cube tests shall be required for loadbearing masonry construction only for the purpose of measuring uniformity of field batching.

2. Compressive Strength Test: Test shall be run according to the requirements of ASTM C780 "Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry."

B. Grout Tests

1. Grout prism tests shall be required for all grout used in masonry construction.

2. Compressive Strength Test: Specimens shall be 3 1/2" x 3 1/2" x 7" or 3" x 3" x 6" cast in molds with a flat nonabsorbent base and masonry units having the same moisture

condition as those being laid forming the sides of the specimens. Specimens shall be capped according to ASTM C617 and tested according to ASTMC39.

3. Frequency of testing: Four grout prisms shall be made for each 30 cubic yards of grout but not less than one set for each day's operation. An additional set should be made whenever the grout mix is changed.

END OF SECTION
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SECTION 01 20 00 - PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Schedule of values.

B. Applications for progress payments.

C. Application at time of substantial completion.

D. Final payment application.

E. Payment for stored materials.

F. Substantiating data.

G. Application for final payment.

H. Defect Assessment.

I. Payments.

1.3 SCHEDULE OF VALUES

A. Use Schedule of Values Form: AIA G703, edition stipulated in the Agreement.

B. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
   1. Application for Payment forms with continuation sheets.
   2. Submittal schedule.
   3. Items required to be indicated as separate activities in Construction Manager's construction schedule.

C. Submit Schedule of Values in duplicate within 10 days after date of Owner-Contractor Agreement.

D. Subschedules of Values
   1. Subschedules: Provide subschedules in a form of submittal shall parallel that of the Schedule of Values, with each item identified the same as the line item in the Schedule of Values.
      a. The unit values for the materials shall be broken down into:
      b. Cost of the material delivered and unloaded at the site, with taxes paid.
      c. Installation costs, including Construction Manager's overhead and profit.
   2. Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values coordinated with each phase of payment.
   3. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
   4. Unit Costs: Submit a Sub-schedule of unit cost and quantities for products on which progress payments will be requested for stored products.
      a. The unit quantity for bulk materials shall include an allowance for normal waste.The installed unit value, multiplied by the quantity listed, shall equal the cost of that item in the Schedule of Values.

E. Format and Content:

1. Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section and one line for each product listed in the Summary section where applicable.
    a. When the project contains more than one facility or school, provide a full breakdown for each facility/school with the total of each facility/school added together to equal the base bids.
        1) Breakdown for each facility/school shall include labor, material, allowances, etc., as indicated below
    b. Identification: Include the following Project identification on the schedule of values:
        1) Project name and location.
        2) Name of Architect.
        3) Architect's project number.
        4) Construction Manager's name and address.
        5) Date of submittal.
    c. Arrange schedule of values consistent with format of AIA Document G703 or Construction Manager’s form as approved by the Architect.
    d. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:
        1) Related Specification Section or Division.
        2) Description of the Work.
        3) Change Orders (numbers) that affect value.
        4) Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
            (a) Labor.
            (b) Materials.
            (c) Equipment.
    e. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
        1) Include separate line items under Construction Manager and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
    f. Round amounts to nearest whole dollar; total shall equal the Contract Sum.

F. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

G. Include in each line item, the amount of Allowances specified in this section. For unit cost Allowances, identify quantities taken from Contract Documents multiplied by the unit cost to achieve the total for the item.

H. Revise schedule to list approved Change Orders, with each Application For Payment.

1.4 APPLICATIONS FOR PROGRESS PAYMENTS

A. Payment format shall in accord with AIA G702 - Application and Certificate for Payment and AIA G703 - Continuation Sheets.

B. Contractor/CM's AIA G702/703 equivalent forms including continuation sheets may be substituted for AIA Payment Forms if preapproved by Owner’s Project Manager.

C. Present handwritten pre-application draft payment forms to Owner for review before submitting applications for payment.

D. After revising draft payment forms, prepare and submit six typewritten copies or on electronic media printout Pay Application as preapproved by Owner.

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E. Execute certification by signature of authorized officer.

F. Use data from Owner preapproved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.

G. List each authorized Change Order as extension on AIA G703 - Continuation Sheet, listing Change Order number and dollar amount as for original item of Work.

H. Prepare Application for Final Payment as specified in Section 01 78 00 – Closeout Submittals.

I. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
   1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

J. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
   1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
   2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
   3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

K. When Architect finds Application properly completed and correct, he will transmit Certificate for Payment to Owner. Incorrect or incomplete Certificates will not be reviewed until they have been corrected and resubmitted by the Contractor.

L. Stored Materials:
   1. Payments may be made for materials stored off-site if preapproved by Owner’s Project Manager and off-site facility is insured and bonded air conditioned warehouse, and only if project site doesn’t allow storage or protection for equipment and supplies.
   2. Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored on site, but not yet installed. Differentiate between items stored on-site and items stored off-site.
   3. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
   4. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
   5. Provide summary documentation for stored materials indicating the following:
      a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
      b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
      c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

M. Transmittal: Submit six (6) signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
   1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
   2. Submit an updated construction schedule with each Application for Payment.
   3. Payment Period: Submit at monthly intervals not later than the fifteenth of the month unless otherwise stipulated in the Agreement.

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4. Submit Release of Liens waivers with each Application for Payment.

N. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
   1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
   2. When an application shows completion of an item, submit conditional final or full waivers.
   3. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
   4. Waiver Forms: Submit executed waivers of lien on forms, acceptable to Owner.

O. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
   1. List of subcontractors.
   2. Schedule of values.
   3. Contractor's construction schedule (preliminary if not final).
   4. Products list (preliminary if not final).
   5. Submittal schedule (preliminary if not final).
   6. List of Contractor's staff assignments.
   7. List of Contractor's principal consultants.
   8. Copies of building permits.
   9. Report of preconstruction conference.
   10. Certificates of insurance and insurance policies
   11. .Performance and payment bonds.
   12. Data needed to acquire Owner's insurance.

P. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
   1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
   2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
   3. Administrative actions and submittals that shall proceed or coincide with this application include:
      a. Occupancy permits and similar approvals.
      b. Warranties (guarantees) and maintenance agreements.
      c. Test/adjust/balance records.
      d. Maintenance instructions.
      e. Meter readings.
      f. Start-up performance reports.
      g. Change-over information, including door lock change over, related to Owner’s occupancy, use, operation and maintenance.
      h. Final cleaning.
      i. Application for reduction of retainage and consent of surety.
      j. Advice on shifting insurance coverage.
      k. Final progress photographs.
      l. List of incomplete work, recognized as exceptions to Architect’s Certificate of Substantial Completion.
   4. After the Certificate of Substantial Completion has been executed by all parties concerned and before payment is made the Contractor shall submit the following documents:

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a. Submit CONSENT OF SURETY TO FINAL REDUCTION IN OR PARTIAL RELEASE OF RETAINAGE, A.I.A. Document G707A, if not previously submitted.

Q. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
4. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
5. AIA Document G707, "Consent of Surety to Final Payment."
6. Evidence that claims have been settled.
7. Final meter readings for utilities and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
8. Final liquidated damages settlement statement.
9. Four (4) signed and notarized original copies and noted as Final Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
10. Final schedule of values.
11. Power of attorney from Surety for release of final payment, signed and sealed and dated same as Consent of Surety.
12. Certificate of Contract Completion:
13. Page one completed by the Construction Manager, submit original plus three copies.
14. Page two completed by the Architect, submit original plus three copies.
15. Construction Manager’s certification letter for the Guarantee of Construction for one year from substantial completion.
16. Copy of the approval and verification of transmittal by the Construction Manager to the Architect of manuals, shop drawings, as builts (one set of sepias and two sets prints), brochures, warranties and list of subcontractors with telephone numbers and addresses.
17. Verification that the owner’s personnel have been trained in the operation of their new equipment (HVAC, controls, fire alarm, etc.) with list of attendees at each training section.
18. Fully executed warranties in the name of the owner.Architect’s Certificate of Specification of Asbestos Containing Materials.
19. Construction Manager’s Certificate of Asbestos Use.
20. Copy of Certificate of Occupancy.

R. When Architect requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

1.5 APPLICATION AT TIME OF SUBSTANTIAL COMPLETION

A. See Supplemental and General Conditions for principal administrative actions and submittals which must precede or coincide with such special applications.

1.6 FINAL PAYMENT APPLICATION

A. See General Conditions, Supplemental Conditions and Closeout Submittals and Procedures for principal administrative actions and submittals which must precede or coincide with such special applications.

1.7 PAYMENT FOR STORED MATERIAL

A. Payment for stored items will be subject to prior approval by the Owner.

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1. On-Site Materials: Progress payments may be made for permanent materials and equipment to be incorporated in the work if approved in advance and properly stored on the project site.
2. Off-Site Materials: Progress payments may be made for permanent, pre-fabricated materials or specially designed equipment to be incorporated into the work if approved in advance per terms of General Conditions and stored in accordance with manufacturer's instructions.

B. Proof of Need: With payment request for stored material, submit a copy of purchase order and payment voucher clearly identifying the material, specification reference, contract number and price. The following additional documentation may be included.
1. Notarized certification of payment from supplier.
2. Copy of canceled check to supplier.
3. Lien release from supplier.
4. Copy of insurance as required by General Conditions.

C. Verification of Price and Payment: The Contractor shall demonstrate that the costs of materials have been paid and will establish the Owner's title to such materials or equipment or otherwise protect the Owner's interest including applicable insurance and transportation for those items stored off-site.

D. Partial payment for materials and equipment in advance of installation shall not constitute acceptance thereof and will not relieve Contractor of full responsibility for condition and subsequent acceptance by the Owner. Faulty materials discovered will be rejected even though partial payment may have been made.

1.8 SUBSTANTIATING DATA

A. When Architect / Engineer requires substantiating information, submit data within three working days, justifying line item amounts in question.

1.9 MODIFICATION PROCEDURES

A. Refer to section 012600 - Contract Modification Procedures.

B. For minor changes not involving an adjustment to the Contract Sum or Contract Time, Architect will issue instructions directly to Contractor on a Supplemental Instruction form - "SI".

C. For other required changes, Architect will issue a document signed by Owner instructing to proceed with the change, for subsequent inclusion in a Change Order for signatures of parties as provided in the Conditions of the Contract on State Field Authorization Form - "FA".
1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
2. Promptly execute the change in Work.

D. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within a timely manner. A change order proposal will be issued by the Architect for signatures of parties as provided in the Conditions of the Contract on State Change Order Proposal Form - "COP".

E. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Construction Manager's price quotation.
2. For change requested by Construction Manager, the amount will be based on the Construction Manager's request for a Change Order as approved by Architect.
3. For change ordered by Architect without a quotation from Construction Manager, the amount will be determined by Architect based on the Construction Manager's substantiation of costs as specified for Time and Material work.

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F. Substantiation of Costs:
   1. When Architect or Owner requires substantiating information, submit data justifying dollar amounts.
   2. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.
   3. Include following data with application:
      a. Partial release of liens from major subcontractors and vendors.
      b. Affidavits attesting to off-site stored products.
      c. Construction progress schedule, revised and corrected to reflect project status at time of payment application.
   4. On request, Provide following data:
      a. Quantities of products, labor, and equipment.
      b. Taxes, insurance, and bonds.
      c. Overhead and profit.
      d. Justification for any change in Contract Time.
      e. Credit for deletions from Contract, similarly documented.
   5. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.

G. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.

1.10 APPLICATION FOR FINAL PAYMENT

A. See Supplemental and General Conditions for principal administrative actions and submittals which must precede or coincide with such special applications.

1.11 DEFECT ASSESSMENT

A. Replace the Work, or portions of the Work, not conforming to specified requirements.

B. If, in the opinion of the Architect, it is not practical to remove and/or replace the Work at the time of application for payment, the Architect will direct one of the following remedies:
   1. The defective Work may remain, but the unit sum/price will be reduced (50%) or an amount at the discretion of the Architect.
   2. The defective Work will be partially repaired to the instructions of the Architect, and the unit sum/price will be adjusted to a new sum/price at the discretion of the Architect.

C. The authority of the Architect to assess the defect and identify payment adjustment, is final.

D. Reduction of the amount requested in the "application for payment" does not constitute Owner's acceptance of the Work or release the Contractor from his obligation to complete and/or correct the work before the next application for payment unless specifically agreed by the Architect and processed via a Change Order.

1.12 PAYMENTS

A. Payments will normally be made to Contractor/CM by 10th of each month, if copies are preapproved by Owner's Project Manager and received by 25th of previous month, unless otherwise stipulated in Agreement.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

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SECTION 01 26 00 - CONTRACT MODIFICATION PROCEDURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

1.3 REFERENCE STANDARDS

A. AIA G709 - Proposal Request; 2018.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 MINOR CHANGES IN WORK

A. Architect will issue Architectural Supplemental Instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions".

1.6 ARCHITECTURAL SUPPLEMENTAL CHANGES

A. Architect will issue Architectural Supplemental Instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions."

B. In the event a change in Contract Sum or Contract Time is required by the Construction Manager, he shall so inform the Architect in writing within one (1) week of receipt of Supplemental Instruction or Clarification. A subsequent Proposal Request and Change Order will be issued prior to the Construction Manager proceeding with the work unless a specific cost and/or time change has been agreed to and authorization to proceed is included in the Supplemental Instruction or is subsequently issued.

C. Architect will sign and date the Supplemental Instruction or Clarification as authorization for the Contractor to proceed with changes.

D. Construction Manager will sign and date the Supplemental Instruction to indicate agreement with the terms therein and return to the Architect.

1.7 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
   1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
   2. Within twenty (20) days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
   3. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
   4. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

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5. Include costs of labor and supervision directly attributable to the change.
6. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
7. Proposal Requests are not valid until Architect and Owner approve in writing. Upon approval the Proposal Request will be incorporated into a Contingency Adjustment Authorization.
8. Quotation Form:
   a. Use AIA G709 – “Proposal Request” Owner’s form.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.
1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in specification section "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Proposal Requests are not valid until Architect and Owner approve in writing. Upon approval the Proposal Request will be incorporated into a Contingency Adjustment Authorization.
8. Proposal Request Form:
   a. Use AIA G709 – “Proposal Request”.

1.8 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714 – “Construction Change Directive” instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

1.9 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Changes Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701 – “Change Order”.

B. Change Order will constitute authorization to proceed with additions and deletions as defined by Proposal Request.

C. Change Order will provide an accounting of the adjustment in the Contract Sum and/or Contract Time.

D. Content of Change Order will be based on either:
1. Architect's Proposal Request and Contractor's responsive Proposal as mutually agreed between Owner and Contractor.
2. Contractor's Proposal for a change as recommended by Architect.

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3. Owner authorized Construction Change Directive as mutually agreed between Owner and Contractor and recommended by Architect.
4. Executed Architect's Supplemental Instructions.

E. Owner will sign and date the Change Order as authorization for the Contractor to proceed with the changes.

F. Contractor will sign and date the Change Order to indicate agreement with the terms therein.

1.10 CORRELATION WITH CONTRACTOR'S SUBMITTAL

A. Periodically revise Schedule of Values and Request for Payment forms to record each change as a separate item of work, and to record the adjusted Contract Sum. Submit along with Applications for Payment.

B. Periodically revise the Construction Schedule to reflect each change in Contract Time:
1. Revise schedules to show changes for other items of work affected by the changes.
2. Submit revised Schedule to Architect and Owner; submit revised schedules to sub-contractors of other work affected by the changes.

1.11 EXECUTION OF CONSTRUCTION CHANGE DIRECTIVES AND PROPOSAL REQUESTS

A. Construction Manager shall, upon receipt of either document, proceed in a timely fashion to execute the documents and incorporate required items into the project when so indicated. Execute documents within two (2) weeks.

B. Construction Manager shall inform all affected trades immediately upon receipt of above mentioned documents and receive written indication of either no change in Contract Price, or a fully itemized breakdown of costs to be incurred. Price breakdowns shall be documented as indicated.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 EXECUTION OF CONSTRUCTION CHANGE DIRECTIVES AND PROPOSAL REQUESTS

A. Construction Manager shall, upon receipt of either document, proceed in a timely fashion to execute the documents and incorporate required items into the project when so indicated. Execute documents within two (2) weeks.

B. Construction Manager shall inform all affected trades immediately upon receipt of above mentioned documents and receive written indication of either no change in Contract Price, or a fully itemized breakdown of costs to be incurred. Price breakdowns shall be documented as indicated.

END OF SECTION

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SECTION 01 30 00.0 - ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. General coordination procedures.
B. General administrative requirements.
C. Information submittals.
D. Project site use plan.
E. Electronic document submittal service.
F. Preconstruction meeting.
G. Progress meetings.
H. Preinstallation conferences.
I. Construction progress schedule.
J. Contractor's daily reports.
K. Progress photographs.
L. Coordination drawings.
M. Requests for Interpretation (RFI) procedures.
N. Submittal schedule.
O. Submittals for review, information, and project closeout.
P. Number of copies of submittals.
Q. Submittal procedures.
R. Submittal review.

1.3 REFERENCE STANDARDS

A. AIA G716 - Request for Information; 2004.
B. AIA G810 - Transmittal Letter; 2001.
C. CSI/CSC Form 12.1A - Submittal Transmittal; Current Edition.
D. CSI/CSC Form 13.2A - Request for Information; Current Edition.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 GENERAL COORDINATION PROCEDURES

A. Coordinate scheduling, submittals, and to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating Owner’s occupancy of completed portions of project or existing building on site, and items to be furnished or installed by Owner.
B. Verify utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

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C. Coordinate space requirements, supports and installation of mechanical and electrical work that is indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with line of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

D. In finished areas, except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

E. In finished areas with exposed ceilings, piping and conduits shall either concealed or be run at right angles and be attached to underside of floor or deck above. Wiring shall not be exposed. Exposed ductwork shall be painted spiral duct.

F. Coordinate completion and clean up of Work of separate sections in preparation for Substantial Completion and for portions of Work designated for Owner's partial occupancy.

G. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accord with Contract Documents, to minimize disruption of Owner's activities.

H. Owner will not consider change orders for extra work required by Contractor due to his inadequate coordination.

I. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.
   1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
   2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
   3. Make adequate provisions to accommodate items scheduled for later installation.

J. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

K. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
   1. Preparation of Construction Manager’s construction schedule.
   2. Preparation of the schedule of values.
   3. Installation and removal of temporary facilities and controls.
   4. Delivery and processing of submittals.
   5. Progress meetings.
   6. Preinstallation conferences.
   7. Project closeout activities.
   8. Startup and adjustment of systems.

L. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
   1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

1.6 GENERAL ADMINISTRATIVE REQUIREMENTS

A. Comply with requirements of Section 01 70 00 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.

B. Make the following types of submittals to Architect:

1. Requests for Interpretation (RFI).
2. Requests for substitution.
3. Shop drawings, product data, and samples.
4. Test and inspection reports.
5. Design data.
6. Manufacturer's instructions and field reports.
7. Applications for payment and change order requests.
8. Progress schedules.
9. Coordination drawings.
10. Correction Punch List and Final Correction Punch List for Substantial Completion.
11. Closeout submittals.

1.7 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
   1. Name, address, and telephone number of entity performing subcontract or supplying products.
   2. Number and title of related Specification Section(s) covered by subcontract.
   3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Within fifteen (15) days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
   1. Post copies of list in temporary field office. Keep list current at all times.

1.8 PROJECT USE SITE PLAN

A. The Construction Manager shall prepare a proposed project use of the site plan.

B. Construction Manager shall confine operations at the site to areas within the areas indicated and as approved on the use of the site plan, and as permitted by law, ordinances, and permits. Site shall not be unreasonably encumbered with materials, products, or construction equipment.

C. The Construction Manager in reviewing his use of the site shall include access to proposed building for construction purposed, storage of materials and products, parking, where possible, for employees, temporary facilities including offices, storage, and workshop sheds or portable trailers, and unloading space.

D. Where a temporary fence is to be provided, the Construction Manager shall show any additional area needed in the Construction Manager’s use of the site beyond that which may be indicated on the Drawings. Where additional fencing is required, such fencing shall be included at no additional cost to the Owner.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF, MS Word, or MS Excel) format, as appropriate to the document, and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.
   1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Interpretation (RFIs), progress documentation, contract modification

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documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Construction Manager's correction punchlist, and any other document any participant wishes to make part of the project record.

2. Construction Manager and Architect are required to use this service.
3. It is Construction Manager's responsibility to submit documents in allowable format.
4. Subcontractors, suppliers, and Architect's consultants will be permitted to use the service at no extra charge.
5. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com), unless such software capability is provided by the service provider.
6. Paper document transmittals will not be reviewed; emailed electronic documents will not be reviewed.
7. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.

B. Submittal Service: The selected service is:
   1. Submittal Exchange (tel: 1-800-714-0024): www.submittalexchange.com/#sle.
   2. EADOC LLC (tel: 1-877-305-3844): www.eadocsoftware.com/#sle.
   3. Newforma ConstructEx: www.newforma.com/our-solutions/constructex/#sle.

C. Training: One, one-hour, web-based training session will be arranged for all participants, with representatives of Architect and Construction Manager participating; further training is the responsibility of the user of the service.

D. Project Closeout: Architect will determine when to terminate the service for the project and is responsible for obtaining archive copies of files for Owner.

3.2 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
   1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
   2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
   3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three (3) days of the meeting.

B. Preconstruction Conference:
   1. Owner’s Project Manager will schedule pre construction conference after Notice to Proceed.
   2. Attendance Required: Owner, Architect, and Contractor/CM.
   3. Agenda:
      a. Execution of Owner-Contractor Agreement, if not executed.
      b. Submission of executed bonds and insurance certificates.
      c. Distribution of Contract Documents.
      d. Submission of list of Subcontractors, list of Products, schedule of values, and progress schedule.
      e. Designation of personnel representing the parties in Contract, and Architect.
      f. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders and Contract closeout procedures.
      g. Scheduling.
      h. Scheduling activities of Geotechnical Engineer.

i. Issuance of Notice to Proceed.

4. Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 10 days after Notice to proceed.
5. Conduct the conference to review responsibilities and personnel assignments.
6. Attendance Required:
   a. Owner
   b. Architect.
   c. Construction Manager.
7. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

C. Site Mobilization Meeting:
1. Owner will schedule meeting at Project site prior to Contractors start of work.
2. Attendance Required: Owner, Architect, Special Consultants, and Contractor, Contractor's Superintendent, and major Subcontractors.
3. Agenda:
   a. Use of premises by Owner and Contractor.
   b. Owner's requirements and partial occupancy.
   c. Construction facilities and controls provided by Owner.
   d. Temporary utilities provided by Owner.
   e. Survey and building layout.
   f. Security and housekeeping procedures.
   g. Schedules.
   h. Application for payment procedures.
   i. Procedures for testing.
   j. Procedures for maintaining record documents.
   k. Requirements for start-up of equipment.
   l. Inspection and acceptance of equipment put into service during construction period.
4. Attendance Required:
   a. Construction Manager.
   b. Owner.
   c. Architect.
   d. Construction Manager's superintendent.
5. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

D. Progress Meetings:
1. Schedule and administer meetings throughout progress of work at weekly intervals. Less frequent meetings may be requested for projects or work stages if requested in writing to the Owner’s Project Manager.
2. Make arrangements for meetings, prepare agenda with copies for participants, and preside meetings.
3. Attendance Required: Job superintendent, major Subcontractors and suppliers, Owner’s
4. Project Manager, Architect, as appropriate to agenda topics for each meeting.
5. Agenda:
   a. Review minutes of previous meetings.
   b. Review previous Work progress.
   c. Field observations, problems, and decisions.
   d. Identification of problems that impede planned progress.
   e. Review of submittals schedule and status of submittals.
   f. Review of off-site fabrication and delivery schedules.
   g. Maintenance of progress schedule.
   h. Corrective measures to regain projected schedules.

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i. Planned progress schedule during succeeding work period.
j. Coordination of projected progress.
k. Maintenance of quality and work standards.
l. Effect of proposed changes on progress schedule and coordination.
m. Other business relating to work.
n. Attendance Required:
    1) Construction Manager.
    2) Owner.
    3) Architect.
    4) Construction Manager's superintendent.
    5) Major subcontractors.
o. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

E. Preinstallation Meetings
1. When required in individual specification section, convene pre-installation meeting at site prior to commencing work of section.
2. Require attendance of parties directly affecting, or affected by, work of specific section.
3. Notify Owner and Architect five working days in advance of meeting date.
4. Prepare agenda and preside at meeting:
    a. Review conditions of installation, preparation and installation procedures.
    b. Review coordination with related work.
5. Record minutes and distribute copies within two days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

F. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 60 days prior to the scheduled date of Substantial Completion.
1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Commissioning Authority, Construction Manager, Architect, and their consultants; Construction Manager and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
    a. Preparation of record documents.
    b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
    c. Submittal of written warranties.
    d. Requirements for preparing operations and maintenance data.
    e. Requirements for delivery of material samples, attic stock, and spare parts.
    f. Requirements for demonstration and training.
    g. Preparation of Construction Manager's punch list.
    h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
    i. Submittal procedures.
    j. Coordination of separate contracts.
    k. Owner's partial occupancy requirements.
    l. Installation of Owner's furniture, fixtures, and equipment.
    m. Responsibility for removing temporary facilities and controls.

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4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

G. Progress Meetings: Conduct progress meetings at weekly, biweekly, monthly intervals.
   1. Coordinate dates of meetings with preparation of payment requests.
   2. Attendees: In addition to representatives of Commissioning Authority, Construction Manager and Architect, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
   3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
      a. Construction Manager’s Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Construction Manager's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
         1) Review schedule for next period.
      b. Review present and future needs of each entity present, including the following:
         1) Interface requirements.
         2) Sequence of operations.
         3) Status of submittals.
         4) Deliveries.
         5) Off-site fabrication.
         6) Access.
         7) Site utilization.
         8) Temporary facilities and controls.
         9) Progress cleaning.
         10) Quality and work standards.
         11) Status of correction of deficient items.
         12) Status of RFIs.
         13) Status of proposal requests.
         14) Pending changes.
         15) Status of Change Orders.
         16) Pending claims and disputes.
         17) Documentation of information for payment requests.
         18) Tracking logs.
      c. Schedule Updating: Revise Construction Manager’s construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

3.3 CONSTRUCTION PROGRESS SCHEDULE

A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of work, with a general outline for remainder of work.

B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
   1. Include written certification that major contractors have reviewed and accepted proposed schedule.

D. Within 10 days after joint review, submit complete schedule.

E. Submit updated schedule with each Application for Payment.

F. Scope of Work:
   1. Preparation of preliminary Construction Schedule, Contractor's/CM/GC final master Construction Schedule, hereinafter called the Construction Schedule, Short Interval Schedules (look ahead), and monthly updates.
   2. Scope of work and project completion are as indicated. Bidders shall include with their bid, a proposed project schedule indicating each item of work in CSI numbering format showing each work division in CPM (Critical Path Method) work sequencing. Schedule shall base critical path on Owner's providing pre purchase of long lead items, and assuming that those products and services are delivered to the Contractor/CM on time for meeting proposed project schedule.

G. Preliminary Project Schedule:
   1. Purpose of preliminary schedule is to determine Bidder's intent as to how work can be prosecuted to allow project completion in specified time frame.
   2. Bidder's shall comply with "The Use of CPM in Construction – A Manual for General Contractors" published by Associated General Contractors of America, Inc. Schedules shall utilize nationally recognized scheduling format such as Primavera or Microsoft Project. Software version selected shall be compatible with Owner's Microsoft Word or Office software so that schedule can be reviewed and saved in Owner's computer system.
   3. Schedule shall be on 11" x17" paper indicating project activities, duration, start and finish dates of each activity, float or slack time, critical path, and total number of days for project.
   4. Include float or slack time in Schedule. Float is defined as amount of time between earliest start date and latest start date or days between earliest end date and latest end date.
   5. Construction schedule shall begin based on Owner's intent to issue Notice to Proceed Letter to Contractor/CM, and be completed within "x" Calendar Days from NTP. Substantial Completion is "date", with "x" calendar days to Final Completion or "date".
   6. Preliminary Project Schedule shall be submitted with Bid Proposal. Failure to do so will be grounds for rejection of the Bid Proposal.

H. Coordination and Project Conditions:
   1. Bidders are responsible for verification of existing conditions to the extent that they are observable and can be inferred by visual inspection.
   2. Verify utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
   3. Coordinate space requirements, supports and installation of mechanical and electrical work that is indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with line of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
   4. In finished areas, except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
   5. In finished areas with exposed ceilings, piping and conduits shall either concealed or painted and be run at right angles, and attached to underside of floor or deck above. Wiring shall not be exposed. Exposed ductwork shall be painted.
   6. Coordinate scheduling to allow time for submittals, Owner's approval, Building Dept. review, permitting and inspections to ensure efficient and orderly sequence of installation of interdependent construction elements. Schedule shall provide for accommodating Owner's occupancy of other buildings on site, and items to be furnished or installed by Owner.
   7. Owner will not consider change orders for extra work required by Contractor due to his inadequate coordination.

3.4 DAILY CONSTRUCTION REPORTS

A. Include only factual information. Do not include personal remarks or opinions regarding operations and/or personnel.

B. Prepare a daily construction report recording the following information concerning events at Project site and project progress:
   1. Date.
   2. High and low temperatures, and general weather conditions.
   3. List of subcontractors at Project site.
   4. List of separate contractors at Project site.
   5. Approximate count of personnel at Project site.
      a. Include a breakdown for supervisors, laborers, journeymen, equipment operators, and helpers.
   6. Major equipment at Project site.
   7. Material deliveries.
   8. Safety, environmental, or industrial relations incidents.
   9. Meetings and significant decisions.
   10. Unusual events (submit a separate special report).
   11. Stoppages, delays, shortages, and losses. Include comparison between scheduled work activities (in Construction Manager's most recently updated and published schedule) and actual activities. Explain differences, if any. Note days or periods when no work was in progress and explain the reasons why.
   12. Directives and requests of authority having jurisdiction (AHJ).
   13. Testing and/or inspections performed.
   14. List of verbal instruction given by Owner and/or Architect.
   15. Signature of Construction Manager's authorized representative.

3.5 PROGRESS PHOTOGRAPHS

A. Submit photographs with each application for payment, taken not more than 3 days prior to submission of application for payment.

B. Submit new photographs at least once a month, within 3 days after being taken.

C. Maintain one set of all photographs at project site for reference; same copies as submitted, identified as such.

D. Photography Type: Digital; electronic files.

E. Provide photographs of site and construction throughout progress of work produced by an experienced photographer, acceptable to Architect.

F. Views:
   1. Provide non-aerial photographs from four cardinal views at each specified time, until date of Substantial Completion.
   2. Consult with Architect for instructions on views required.
   3. Provide factual presentation.
   4. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.
   5. Digital Photographs: 24 bit color, minimum resolution of 1024 by 768, in JPG format; provide files unaltered by photo editing software.
      a. File Naming: Include project identification, date and time of view, and view identification.

3.6 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is

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required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
    a. Use applicable drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
    b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
    c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
    d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
    e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
    f. Indicate required installation sequences.
    g. Indicate dimensions shown on the drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:
    1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
    2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on drawings. Indicate areas of conflict between light fixtures and other components.
    3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
    4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
    5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
    6. Mechanical and Plumbing Work: Show the following:
        a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
        b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts, and electrical distribution equipment.
        c. Fire-rated enclosures around ductwork.
    7. Electrical Work: Show the following:
        a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
        b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.

c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
d. Location of pull boxes and junction boxes, dimensioned from column center lines.

8. Fire-Protection System: Show the following:
   a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
9. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.
10. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in this Section.

C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
   1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
   2. File Submittal Format: Submit or post coordination drawing files using Portable Data File (PDF) format.
   3. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.
      a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to drawings.
      b. Contractor shall execute a waiver agreement using the "Digital Data Release Form" included in this section, prior to release of digital files.

3.7 REQUESTS FOR INTERPRETATION (RFI)

A. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.

B. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
   1. Prepare a separate RFI for each specific item.
   2. Prepare in a format and with content acceptable to Owner.

C. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
   1. Include in each request Construction Manager's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.
   2. Unacceptable Uses for RFIs: Do not use RFIs to request the following:
      a. Approval of submittals (use procedures specified elsewhere in this section).
      b. Approval of substitutions (see Section - 01 60 00 - Product Requirements)
      c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).
      d. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).
   3. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response, with an explanatory notation.
   4. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response, with an explanatory notation.

a. The Owner reserves the right to assess the Construction Manager for the costs (on time-and-materials basis) incurred by the Architect, and any of its consultants, due to processing of such RFIs.

D. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
1. Official Project name and number, and any additional required identifiers established in Contract Documents.
2. Owner's, Architect's, and Construction Manager's names.
3. Discrete and consecutive RFI number, and descriptive subject/title.
4. Issue date, and requested reply date.
5. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
6. Annotations: Field dimensions and/or description of conditions which have engendered the request.
7. Construction Manager's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.

E. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.

F. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
1. Indicate current status of every RFI. Update log promptly and on a regular basis.

G. Review Time: Architect will respond and return RFIs to Construction Manager within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.

H. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Construction Manager's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.
1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.
4. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

3.8 SUBMITTAL SCHEDULE

A. Submit to Architect for review a schedule for submittals in tabular format.
1. Coordinate with Construction Manager's construction schedule and schedule of values.
2. Format schedule to allow tracking of status of submittals throughout duration of construction.

3. Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), description of item of work covered, and role and name of subcontractor.
4. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.
    a. For assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make corrections or revisions to initial submittals, and time for their review.
5. Initial Submittal: Submit concurrently with preliminary bar-chart schedule. Include submittals required during the first 60 days of construction. List those required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
6. Final Submittal: Submit concurrently with the first complete submittal of Contractor's Construction Schedule.

3.9 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
    1. Product data.
    2. Shop drawings.
    3. Samples for selection.
    4. Samples for verification.

B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.

C. Samples will be reviewed for aesthetic, color, or finish selection.

D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 78 00 - Closeout Submittals.

3.10 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:
    1. Design data.
    2. Certificates.
    3. Test reports.
    4. Inspection reports.
    5. Manufacturer's instructions.
    6. Manufacturer's field reports.
    7. Other types indicated.

B. Submit for Architect's knowledge as contract administrator or for Owner.

C. Certificates:
    1. When specified, submit certification by manufacturer, installation/application subcontractor, or contractor to Engineer, in quantities specified for Product Data.
    2. Indicate material or Product conforms to or exceeds specified requirements.
    3. Submit supporting reference date, affidavits, and certifications as appropriate.
    4. Certificates may be recent or previous test results on material or Product, but must be acceptable to Engineer.

D. Manufacturer’s Instructions
    1. When specified, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, to Engineer for delivery to Owner in quantities specified for Product Data.

E. Manufacturer’s Field Reports
    1. Submit reports to Engineer and Owner’s Project Manager.

2. Submit report within 30 days of observation to Engineer.
3. Submit for information for purpose of assessing conformance with information given and design concept expressed in Documents.

3.11 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.

B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 78 00 - Closeout Submittals:
1. Project record documents.
2. Operation and maintenance data.
3. Warranties.
4. Bonds.
5. Other types as indicated.

D. Final Property Survey.

E. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

F. Submit number of copies required by Contractor, plus one copy for Engineer and two copies for Owner.

G. Submit to Engineer for Owner's benefit during and after project completion.
1. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
2. Submit one copy and one reproducible copy required by Contractor/CM, plus one copy for Engineer and two copies for Owner.

3.12 NUMBER OF COPIES OF SUBMITTALS

A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

B. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
1. After review, produce duplicates.
2. Retained samples will not be returned to Construction Manager unless specifically so stated.

3.13 SUBMITTAL PROCEDURES

A. General Requirements:
1. Submittal Procedures shall be in conformance with AIA A201 General Conditions of the Contract and as amended by Owner on July 13, 2009.
2. Transmit each submittal with AIA Form G810-2001 or Owner’s Standard Transmittal form.
3. Use a single transmittal for related items.
4. Transmit using approved form.
   a. Use Construction Manager's form, subject to prior approval by Architect.
5. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
6. Identify: Project; Construction Manager; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
7. Apply Construction Manager's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.

a. Submittals from sources other than the Construction Manager, or without Construction Manager's stamp will not be acknowledged, reviewed, or returned.

8. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
   a. Send submittals in electronic format via email to Architect.
9. Schedule submittals to expedite the Project, and coordinate submission of related items.
   a. For each submittal for review, allow 15 days excluding delivery time to and from the Construction Manager.
   b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 7 days.
   c. For sequential reviews involving approval from authorities having jurisdiction (AHJ), in addition to Architect's approval, allow an additional 30 days.
10. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
11. Provide space for Construction Manager and Architect review stamps.
12. When revised for resubmission, identify all changes made since previous submission.
13. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
14. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
15. Submittals not requested will not be recognized or processed.

B. Construction Submittals:
   1. Submit one copy of Building Permit, Site Permits, Environmental Permits, or other permits required for construction of work.
   2. Submit Payment Applications to Engineer for review for purpose of checking conformance with information given and design concept expressed in Contract Documents.

C. Product Data Procedures:
   1. Within 15 work days after date of Notice to Proceed, submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
   2. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.
   3. Submit only information required by individual specification sections.
   4. Product Design Data and Test Reports:
      a. Submit to Engineer as contract administrator and for Owner’s Project Manager for purpose of checking conformance with information given and completed work on project.
   5. Collect required information into a single submittal.
   6. Do not submit (Material) Safety Data Sheets for materials or products.
   7. Submit to Engineer for review for purpose of checking for conformance with information given and design concept expressed in Contract Documents.
   8. After review, provide copies and distribute per Submittal Procedures article above and for record documents purposes described in Section 01 78 00 – Closeout Submittals.
   9. Product Data for Information:
   10. Submittal for Engineer's knowledge as contract administrator or for Owner.
   11. Product Data for Project Close-out:
   12. Submit for Owner's benefit during and after project completion.
   13. Submit number of copies required by Contractor/CM plus two copies for transmittal to
   14. Engineer and two copies for transmittal to Owner’s Project Manager.
   15. Mark each copy to identify applicable products, models, options, and other data.
   16. Supplement manufacturers' standard data to provide information unique to project.

17. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
18. After review, distribute in accord with Submittal Procedures article above and provide copies for record documents described in Section 01 78 00 - Closeout Submittals.

D. Shop Drawing Procedures:
1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
2. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.
3. Submit drawings to Engineer and Owner's Project Manager.
4. Submit for information for purpose of assessing conformance with information given and design concept expressed in Documents.
5. Data indicating inappropriate or unacceptable work is subject to rejection by Engineer or Owner.
6. Provide following information:
   a. Fabrication and installation Drawings and details.
   b. Template placement diagrams.
   c. Manufacturer's installation instructions.
   d. Product patterns and colors.
   e. Coordination Drawings.
   f. Schedules.
   g. Product product mix formulae.
   h. Product design or engineering calculations.
   i. Other information as required by project.
   j. After review, produce copies and distribute per Submittal Procedures article above and for record documents purposes described in Section 01 78 00 – Closeout Submittals.
   k. Submit to Engineer for purpose of checking conformance with information given and
   l. design concept and Owner's Project Manager.

E. Samples Procedures:
1. Transmit related items together as single package.
2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.
3. Submit to Engineer for purpose of checking conformance with information given and design concept expressed in the documents.
4. After review, Engineer shall submit color board to Owner's Project Manager per Submittal Procedures.
5. Sample finishes and colors shall be from full range of manufactures' standard colors, textures, and patterns for Engineer's selection and preparation of color board for Owner's approval.
6. After review and approval by Owner, provide duplicates and distribute per Submittal Procedures.
7. Submit samples to illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
8. Include identification on each sample, with full project information.
   a. Submit number of samples specified in specification, one of which Engineer shall retain.
   b. Reviewed samples may be used in work, if indicated.

3.14 SUBMITTAL REVIEW

A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.

B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.

C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.

D. Architect's and consultants' actions on items submitted for review:
   1. Authorizing purchasing, fabrication, delivery, and installation:
      a. "Approved", or language with same legal meaning.
      b. "Approved as Noted, Resubmission not required", or language with same legal meaning.
         1) At Construction Manager's option, submit corrected item, with review notations acknowledged and incorporated.
      c. "Approved as Noted, Resubmit for Record", or language with same legal meaning.
         1) Resubmit corrected item, with review notations acknowledged and incorporated. Resubmit separately, or as part of project record documents.
         2) Non-responsive resubmittals may be rejected.
   2. Not Authorizing fabrication, delivery, and installation:
      a. "Revise and Resubmit".
         1) Resubmit revised item, with review notations acknowledged and incorporated.
         2) Non-responsive resubmittals may be rejected.
      b. "Rejected".
         1) Submit item complying with requirements of Contract Documents.

E. Architect's and consultants' actions on items submitted for information:
   1. Items for which no action was taken:
      a. "Received" - to notify the Construction Manager that the submittal has been received for record only.
   2. Items for which action was taken:
      a. "Reviewed" - no further action is required from Construction Manager.

END OF SECTION

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DIGITAL DATA RELEASE FORM

Project:	{Insert Project Name}	**Date:**	MM/DD/YYYY
Project Number:	12345	**Contractor:**	{Insert Contractor Name} {Insert Contractor's Address} {Insert Contractor's Address}
Architect of Record:	PBK Architects, Inc. {Insert Office Address} {Insert Office Address}		

Digital Data refers to electronic representation of information, drawings, and designs created and stored in digital form including Building Information Modeling (BIM) files, CAD files, and other formats that are digital representations of the project. PBK will provide the following {Revit / CAD} dated {MM/DD/YYYY} for the convenience of the Contractor.

Digital Data were prepared on the following:

Computer Hardware/Operating System – {Microsoft Windows 10}

Software Application and Version – {type here}

Contractor shall pay PBK a service fee of $0.00.

TERMS & CONDITIONS

1. PBK makes no representation as to the compatibility of the Digital Data with any hardware or software.
2. Since the information set forth on the Digital Data can be modified unintentionally or otherwise, PBK reserves the right to remove all indicia of its ownership and/or involvement from each electronic display.
3. All information on the digital data is considered Instruments of Service of PBK and shall not be used for other projects, for additions to this project, or completion of this project by others. The Digital Data shall remain the property of PBK and in no case shall the transfer of these files be considered a sale.
4. PBK makes no representation regarding the accuracy, completeness, or permanence of the Digital Data, or for their merchantability or fitness for a particular purpose. Addenda information or revisions made after the date indicated on the Digital Data may not have been incorporated. In the event of a conflict between PBK's sealed contract drawings and the Digital Data, the sealed contract drawings shall govern. It is the Contractor's responsibility to determine if any conflicts exist. The Digital Data shall not be considered to be Contract Documents as defined by the General Conditions of the Contract for Construction.
5. The use of Digital Data prepared by PBK shall not in any way obviate the Contractor's responsibility for the proper checking and coordination of dimensions, details, and quantities of materials as required to facilitate complete and accurate fabrication and erection.
6. The Contractor shall, to the fullest extent permitted by law, indemnify, defend, and hold harmless PBK and its consultants from all claims, damages, losses, expenses, penalties, and liabilities of any kind, including attorney's fees, arising out of or resulting from the use of the Digital Data by the Contractor, or by third party recipients of the Digital Data from the Contractor.
7. PBK believes that no licensing or copyright fees are due to others on account of the transfer of the Digital Data, but to the extent any are, the Contractor will pay the appropriate fees and hold PBK harmless from such claims.
8. Payment of the service fee is due upon receipt of the Digital Data.

_____	_____
Name & Title (Architect)	Name & Title (Contractor)
_____	_____
Signature Date	Signature Date

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SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Construction Manager of responsibility for compliance with the Contract Document requirements.
   1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
   2. Specified tests, inspections, and related actions do not limit Construction Manager's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
   3. Requirements for Construction Manager to provide quality-assurance and -control services required by Architect, Owner, Commissioning Authority, Construction Manager or authorities having jurisdiction are not limited by provisions of this Section.
   4. Specific test and inspection requirements are not specified in this Section.

B. Submittals.

C. Quality assurance.

D. References and standards.

E. Testing and inspection agencies and services.

F. Control of installation.

G. Tolerances.

H. Manufacturers' field services.

I. Defect Assessment.

J. Administrative and procedural requirements for quality assurance and quality control.

K. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Construction Manager of responsibility for compliance with the Contract Document requirements.
   1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
   2. Specified tests, inspections, and related actions do not limit Construction Manager’s other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
   3. Requirements for Construction Manager to provide quality-assurance and -control services required by Architect, Owner, Commissioning Authority, Construction Manager, or authorities having jurisdiction are not limited by provisions of this Section.
   4. Specific test and inspection requirements are not specified in this Section.

1.3 REFERENCE STANDARDS

A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008 (Reapproved 2023).

B. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation; 2026.

C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry; 2025.

D. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2023.

E. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2025b.

F. ASTM E699 - Standard Specification for Agencies Involved in Testing, Quality Assurance, and Evaluating of Manufactured Building Components; 2016.

G. IAS AC89 - Accreditation Criteria for Testing Laboratories; 2025.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 DEFINITIONS

A. Refer to Section 01 42 16 - Definitions for the following terms:
   1. Contractor's Quality Control Plan.
   2. Contractor's Professional Design Services.
      a. Design Services Types Required:
         1) Construction-Related.
         2) Design-Related.
   3. Design Data.
   4. Experienced.
   5. Source Quality-Control Testing.
   6. Field Quality-Control Testing.
   7. Installer/Applicator/Erector.
   8. Testing Agency.
   9. Pre-construction Testing.
   10. Product Testing.
   11. Quality-Assurance Services.
   12. Quality-Control Services.
   13. Mockups.
      a. Laboratory Mockups
      b. Integrated Exterior Mockups.
      c. Room Mockups.

1.6 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.7 SUBMITTALS

A. Shop Drawings:
   1. Provide plans, sections, elevations, and details indicating materials and size.

2. Indicate manufacturer and model number of individual components.
3. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.8 INFORMATIONAL SUBMITTALS

A. Construction Manager's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

B. Qualification Data: For Construction Manager's quality-control personnel.

C. Construction Manager's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:
1. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.

D. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

1.9 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
1. Date issued.
2. Project title and number.
3. Name of inspector.
4. Date and time of sampling or inspection.
5. Description of the Work and test and inspection method.
   a. Identification of product and specifications section.
6. Location in the Project.
7. Complete test or inspection data.
8. Date of test/inspection.
9. Results of test/inspection.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.
14. Compliance with Contract Documents.
   a. When requested by Architect, provide interpretation of results.
15. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.

7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
   1. Name, address, and telephone number of factory-authorized service representative making report.
   2. Statement that equipment complies with requirements.
   3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
   4. Statement whether conditions, products, and installation will affect warranty.
   5. Other required items indicated in individual Specification Sections.

D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

E. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Construction Manager or installation/application subcontractor to Architect, in quantities specified for Product Data.
   1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

F. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

G. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.
   1. Submit report in duplicate within 30 days of observation to Architect for information.
   2. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

H. Erection Drawings: Submit drawings for Architect's benefit as contract administrator or for Owner.
   1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.
   2. Data indicating inappropriate or unacceptable Work may be subject to action by Architect or Owner.

1.10 CONSTRUCTION MANAGER'S QUALITY-CONTROL PLAN

A. Quality-Control Plan, General: Submit quality-control plan within ten (10) days of Notice to Proceed, and not less than five (5) days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Construction Manager's quality-assurance and quality-control responsibilities. Coordinate with Construction Manager's construction schedule.

B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
   1. Project quality-control manager may also serve as Project superintendent.

C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:

1. Owner-performed tests and inspections indicated in the Contract Documents, including tests and inspections indicated to be performed by the Commissioning Authority.
2. Owner-performed tests and inspections indicated in the Contract Documents.

E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements.

F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.11 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

C. Comply fully with manufacturers' instructions, including each step in sequence.

D. Comply fully with manufacturers' instructions, including each step in sequence.

E. Should manufacturers' instructions conflict with contract documents, request clarification from Architect before proceeding, and document any instructions or directions that may invalidate warranty.

F. Comply with specified standards as a minimum quality for work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

G. Perform work by persons qualified to produce workmanship of specified quality.

H. Verify that field measurements are as indicated on shop drawings or as instructed by manufacturer.

I. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

J. Schedule work so no absorbent materials are installed and no concealed areas are closed up until building is dried-in and permanent doors and windows are installed to prevent development of mold or entrapment of mold or moisture inside concealed spaces or moisture absorption into interior materials.

K. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

L. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

M. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

N. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

O. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
   1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

P. Testing Agency Qualifications: An independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

Q. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

R. Coordination:
   1. Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
   2. Coordinate scheduling, submittals, and work to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
   3. Schedule times for tests, inspections, obtaining samples, and similar activities.
   4. Verify utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
   5. Coordinate space requirements, supports and installation of mechanical and electrical work that is indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel or perpendicular with line of building. Conduits and piping shall be spaced neatly, consistently and uniformly when in groupings. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
   6. In finished areas, except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
   7. Coordinate completion and clean up of Work of separate sections in preparation for Substantial Completion and for portions of Work designated for Owner's partial occupancy.
   8. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.
   9. Owner will not consider change orders for extra work required by Contractor/CM due to improper or untimely coordination.

S. Field Engineering:
   1. Employ a Land Surveyor registered in the State of Florida, acceptable to Architect and Owner for construction layout.
   2. Contractor/CM shall locate and protect survey control and reference points.
   3. Control datum for survey is that established by Owner provided survey.
   4. Verify setbacks and easements; confirm drawing dimensions and elevations.
   5. Provide field engineering services. Establish elevations, lines, and levels, utilizing recognized engineering survey practices.
   6. Upon completion of project, surveyor noted above, shall prepare and submit copy of site drawing and certificate signed by Land Surveyor that elevations and locations of Work are in accord with Contract Documents.

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T. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
   1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
   2. Notify Architect seven (7) working days in advance of dates and times when mockups will be constructed.
   3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
   4. Demonstrate the proposed range of aesthetic effects and workmanship.
   5. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
      a. Allow seven (7) days for initial review and each re-review of each mockup.
   6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
   7. Demolish and remove mockups when directed unless otherwise indicated.

U. Integrated Exterior Mockups: Construct integrated exterior mockup in accordance with approved shop drawings. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials.

V. Room Mockups: Construct room mockups incorporating required materials and assemblies, finished in accordance with requirements. Provide required lighting and additional lighting where required to enable Architect to evaluate quality of the Work. Provide room mockups where indicated on drawings.

W. Testing Agency Qualifications:
   1. Prior to start of work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
   2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
   3. Qualification Statement: Provide documentation showing testing laboratory is accredited under IAS AC89.

X. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of Construction Manager by Contract Documents, provide services of a Professional Engineer experienced in design of this type of work and licensed in Florida.

Y. Construction Manager's Quality Control (CQC) Plan:
   1. Prior to start of work, submit a comprehensive plan describing how contract deliverables will be produced. Tailor CQC plan to specific requirements of the project. Include the following information:
      a. Management Structure: Identify personnel responsible for quality. Include a chart showing lines of authority.
         1) Include qualifications (in resume form), duties, responsibilities of each person assigned to CQC function.
      b. Management Approach: Define, describe, and include in the plan specific methodologies used in executing the work.
         1) Management and control of documents and records relating to quality.
         2) Communications.
         3) Coordination procedures.
         4) Resource management.
         5) Process control.
         6) Inspection and testing procedures and scheduling.
         7) Control of noncomplying work.

8) Tracking deficiencies from identification, through acceptable corrective action, and verification.
9) Control of testing and measuring equipment.
10) Project materials certification.
11) Managerial continuity and flexibility.

c. Owner will not make a separate payment for providing and maintaining a Quality Control Plan. Include associated costs in Bid price.

d. Acceptance of the plan is required prior to start of construction activities not including mobilization work. Owner's acceptance of the plan will be conditional and predicated on continuing satisfactory adherence to the plan. Owner reserves the right to require Construction Manager to make changes to the plan and operations, including removal of personnel, as necessary, to obtain specified quality of work results.

Z. Quality-Control Personnel Qualifications. Engage a person with requisite training and experience to implement and manage quality assurance (QA) and quality control (QC) for the project.

1.12 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Administration Requirements."

C. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

D. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

E. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.

3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.
8. Provide a rain gauge on site acceptable to the testing agency and log daily rainfall. Copies of log shall be made to testing agency and local authorities upon demand.

F. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.13 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency/special inspector to conduct special tests and inspections required by Chapter 17 of the International Building Code as the responsibility of Owner, as indicated in Statement of Special Inspections attached to this Section, and as follows:
1. Special Test and Inspections shall be in accordance with the “Schedule of Special Inspection Services,” form included at the end of this section.
a. All testing/inspections indicated as applicable to this Project shall be performed in accordance with and to the extent indicated on the “Schedule of Special Inspections.”
b. These forms shall be maintained in a central location at the Project Site. These forms will need to be accessed on a regular basis by the Agent (Special Inspector(s) for the Project.
c. When an individual Special Inspection task in the Schedule is completed for the last time on the Project and the Special Inspector has performed their final review, inspection, or test of that item for the Project, the Special Instructor shall initial and date the cell in the completed column on the forms adjacent to the task.
2. Special Inspectors shall keep records of all tests and inspections. The Special Inspector shall provide copies of Inspection Reports to the Contractor, Architect, Engineer of Record, and the Building Official.
a. Reports shall indicate that the Work inspected was done in conformance to the Contract Documents. Work not in conformance with the Contract Documents shall be brought to the attention of the Contractor for immediate correction. Retesting/inspection shall be performed to insure compliance with Contract Documents.
b. Reports shall be submitted on a monthly basis.
3. A “Final Report of Special Inspections” shall be provided for the Project at the completion of all Special Inspections and Testing required for this Project.
a. Each Special Inspector corresponding to an Agent in the “Schedule of Special Inspections” shall be required to complete a copy of this form.
b. Copies of all “Final Report(s) of Special Inspections” shall be provided to the Contractor, Architect, Engineer of Record, and the Building Official.
4. Special Inspections will not be considered complete until all forms from all Agents (Special Inspector(s)) have been received.

1.14 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.

C. Obtain copies of standards where required by product specification sections.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from Contract Documents by mention or inference otherwise in any reference document.

1.15 TESTING AND INSPECTION AGENCIES AND SERVICES

A. Owner will employ and pay for services of an independent testing agency to perform specified testing.
   1. Owner will appoint and pay for services specified for independent firm to perform testing.
   2. Independent firm will perform tests and other specified services as outlined in individual specification sections and as required by Owner.
   3. Testing and quality control may occur on or off project site.
   4. Independent firm shall submit reports to Owner and Architect and Contractor/CM, indicating observations and results of tests and compliance or non-compliance with contract documents.
   5. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.
      a. Notify Owner, Architect and independent firm 24 hours prior to expected time for operations requiring services.
      b. Make arrangements with independent firm and pay for additional samples and tests required for Contractor's use.
      c. Testing does not relieve Contractor to perform work per contract requirements.
      d. As directed by Architect, independent testing firm shall re-test as result of non-conformance with requirements. Contractor shall pay for re-testing cost by deducting testing charges from the Contract Sum/Price.

B. As indicated in individual specification sections, Owner shall employ and pay for services of an independent testing agency to perform specified testing.

C. Employment of agency in no way relieves Construction Manager of obligation to perform Work in accordance with requirements of Contract Documents.

1.16 BUILDING INSPECTION SERVICES

A. Owner will employ in-house Building Official, or hire independent Building Official and Construction Inspectors as required to perform Document review and approval, and on-site building inspections in accord with Florida Building Code, Section 423 State Requirements for Educational Facilities and other applicable codes.

B. Building Official and Inspectors will perform code interpretation, document review, project inspections, and other services specified and required in individual specification sections, and shall be paid by Owner.

C. Inspections firm will conduct inspections and observations of work, indicate compliance or non-compliance with applicable codes and contract documents, and will submit reports to Architect, Contractor/CM and Owner.

D. Cooperate with inspection firm; provide safe access and assistance by incidental labor as requested.

E. Notify Owner and Architect and inspection firm 24 hours prior to expected time for operations requiring services.

F. Inspection of work does not relieve Contractor of performing work in accord with contract requirements.

1.17 MANUFACTURERS' FIELD SERVICES

A. Where specified, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment and as applicable, and to initiate instructions when necessary.

B. Submit qualifications of observer to the Architect 30 days in advance of required observations, the observer is subject to Owner's approval.

C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

1.18 COMMISSIONING

A. Comply with Section 01 91 00 – Commissioning for training of Owner’s personnel in operation and maintenance of equipment identified in this Section.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work, beginning new work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work.

C. Examine and verify specific conditions described in individual specification sections. Immediately notify AE or Owner’s Project Manager of conditions that would prevent meeting contractual requirements.

D. Verify that utility services are available, of correct characteristics, and in correct locations.

3.2 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance in manner approved by product manufacturer.

C. Apply manufacturer’s required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.3 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

H. Tolerances:
   1. Monitor fabrication and installation tolerance control of products to produce acceptable work. Do not permit tolerances to accumulate.
   2. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with contract documents, most stringent tolerance shall prevail.

3.4 MOCK-UPS

A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.

B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.

C. Assemble and erect specified items with required attachment and anchorage devices, flashings, seals, and finishes.

D. Construct mockups as indicated for review by Architect and Owner’s Project Manager.

E. Accepted mock-ups shall be basis of work quality standard for work.

F. Where Architect accepts mockups as quality standard of work required, maintain mockups until work is complete.

G. Upon Architect’s approval mockups and work samples may be incorporated in completed work. Otherwise, remove mock-up and clear area.

H. Integrated Exterior Mock-ups: Construct integrated exterior mock-up as indicated on drawings. Coordinate installation of exterior envelope materials and products as required in individual Specification Sections. Provide adequate supporting structure for mock-up materials as necessary.

I. Notify Architect fifteen (15) working days in advance of dates and times when mock-ups will be constructed.

J. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.

K. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.

L. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

M. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.
   1. Architect will issue written comments within seven (7) working days of initial review and each subsequent follow up review of each mock-up.
   2. Make corrections as necessary until Architect's approval is issued.

N. Architect will use accepted mock-ups as a comparison standard for the remaining Work.

O. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

3.5 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

3.6 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
   1. Date test or inspection was conducted.
   2. Description of the Work tested or inspected.
   3. Date test or inspection results were transmitted to Architect.
   4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.7 TESTING AND INSPECTION

A. See individual specification sections for testing and inspection required.

B. Testing Agency Duties:
   1. Test samples of mixes submitted by Construction Manager.
   2. Provide qualified personnel at site. Cooperate with Architect and Construction Manager in performance of services.
   3. Perform specified sampling and testing of products in accordance with specified standards.
   4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   5. Promptly notify Architect and Construction Manager of observed irregularities or non-compliance of Work or products.
   6. Perform additional tests and inspections required by Architect.
   7. Attend preconstruction meetings and progress meetings.
   8. Submit reports of all tests/inspections specified.

C. Limits on Testing/Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the Work.
   3. Agency may not assume any duties of Construction Manager.
   4. Agency has no authority to stop the Work.

D. Construction Manager Responsibilities:
   1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
   2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
   3. Provide incidental labor and facilities:
      a. To provide access to Work to be tested/inspected.
      b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
      c. To facilitate tests/inspections.
      d. To provide storage and curing of test samples.
   4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
   5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Construction Manager beyond specified requirements.
   6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Construction Manager beyond specified requirements.

E. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.

F. Re-testing required because of non-compliance with specified requirements shall be paid for by Construction Manager.

3.8 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.

B. Submit qualifications of observer to Architect 30 days in advance of required observations.

C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.9 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
   1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.

B. Protect construction exposed by or for quality-control service activities.

C. Replace Work or portions of the Work not complying with specified requirements.

END OF SECTION

SECTION 01 41 00 - REGULATORY REQUIREMENTS (FLORIDA)

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 CODE REQUIREMENTS

A. Perform all work on this Project in strict accordance with, but not limited to, applicable requirements and portions of the latest adopted editions of the currently adopted codes, revisions, amendments, supplements, and their references.
   1. Florida Building Codes (FBC):
      a. Building Code, FBC 8th Edition (2023), with Applicable Amendments, and including Section 453.
      b. Existing Building; FBC 8th Edition, or most current editiion.
      c. Mechanical: FBC Mechanical Code 8th Edition (2023) with applicable amendments.
      d. Electrical: FBC Electrical Code 8th Edition (2023) with applicable amendments.
      e. Plumbing: FBC Plumbing Code 8th Edition (2023) with applicable amendments.
      f. Gas Fuel Code: FBC Gas Fuel Code 8th Edition with applicable amendments.
      g. Accessibility Code: Florida Accessibility Code (FAC) for Building Construction, 8th Edition (2023).
      h. Fire Safety Code: Florida Fire Prevention Code (FFPC) 8th Edition (2023), including reference to "Mandatory Codes and Standards" listed as rule number 69A-60.005 "Publications Referenced in NFPA 1, and NFPA 101" current edition.
      i. Energy Conservation, 8th Edition (2023), or most current edition.
   2. Florida Energy Code (FEC); 8th Edition (2023), or most current edition.
   3. Florida Administrative Code:
      a. Florida Fire Prevention Code including reference to "Mandatory Codes and Standards" listed as rule number 69A-60.005 "Publications Referenced in NFPA 1, and NFPA 101" current edition.
   4. National Fire Protection Association, National Electrical Code:
      a. NFPA 1 - Fire Code, 2021 Edition with applicable amendments.
      b. NFPA101 - Life Safety Code, 2021 Edition with applicable amendments.
      c. NFPA 80 – Standard for Fire Doors and Fire Windows.
         1) NFPA 80/105-2019; NFPA 110/111-2019; NFPA 780-2020; NFPA 855-2020.
      d. NFPA 70 - National Electric Code (NEC) 2020.
         1) NFPA 13 - 2019; NFPA 14-2019; NFPA 20-2019; NFPA 25-2020.
         2) NFPA 96-2021; NFPA 90A/90B-2021; NFPA 72 (edition enforced by AHJ under FFPC 8th Edition (2023).
   5. Accessibility:
      a. U.S. Department of Justice, Americans with Disabilities Act (ADA), 2010 ADA Standards for Accessible Design.
      b. U.S. Access Board, Americans with Disabilities Act Architectural Guidelines (ADAAG), Accessibility Guidelines for Buildings and Facilities.
      c. U.S. Access Board, Americans with Disabilities Act Architectural Guidelines (ADAAG), accessibility requirements for children, July 23, 2004.
   6. American Society of Civil Engineers – ACSE 7:
      a. Minimum Design Loads for Buildings and Other Structures.
      b. Minimum Finished Floor Elevations: The Contractor shall furnish the county with a signed and sealed "Flood Elevation Certificate" certifying compliance of the finished floor elevations for all new construction.

7. Florida Statutes:
   a. Miami-Dade County Code Compliance Office: Product Control Division, Notice of Acceptance (NOA).
   b. Florida Statute 255.0993 - The United Stated - Produced Iron and Steel products, 2024.
8. Florida Department of Education (FDOE):
   a. State Requirements for Education Facilities (SREF).
   b. Chapter 69A-58 FAC, Uniform Fire Safety Standards for Educational Facilities.
   c. Educational Specifications (Ed Specs)
   d. Martin County School District "Attachment C MCSD Design Criteria 2025" design and specifications guidelines published by the Martin County School District Facilities Department.
9. Elevators and Escalators:
   a. Florida Elevator Safety code.
   b. ASME/ANSI A17.1 – Safety Code for Elevators and Escalators.
   c. Components, accessories, fabricated parts, and structure requirements shall comply with the current ANSI/ASME A17.1-2013 and ANSI A117.1-2009.
   d. Bureau of Elevators of the Department of Business Regulation according to Chapter 399 of the Florida Statutes.

1.3 CODE STANDARDS

A. All work shall conform to applicable portions of the adopted, or the latest edition of the standards listed, which shall include, but is not limited to, the following:
   1. Aluminum Association (AA).
   2. American Association of Automatic Door Manufacturers (AAADM).
   3. American Concrete Institute (ACI).
   4. American Institute of Steel Construction (AISC).
   5. American National Standards Institute (ANSI).
   6. American Society for Testing and Materials (ASTM).
   7. American Society of Mechanical Engineers (ASME).
   8. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).
   9. American Welding Society (AWS).
   10. Architectural Woodworking Institute (AWI).
   11. Architectural Aluminum Manufacturer's Association (AAMA).
   12. Commercial Standards (CS).
   13. Federal Specifications and Standards (FSS).
   14. Global Standards: International Organization for Standardization (ISO); ISO 9001 -Quality Management Systems.
   15. Occupational Safety and Health Administration (OSHA).
   16. National Institute for Standards and Technology (NIST).
   17. Sheet Metal and Air Conditioning Contractor's National Association (SMACNA), Metal Finishes Manual for Architectural and Metal Products.
   18. Underwriter's Laboratories (UL).
   19. U.S. of America Standards Institute (ASI).
   20. U.S. Department of Commerce Product Standards (USDCPS).

1.4 REFERENCE STANDARDS

A. Comply with applicable portions of the Referenced Standards listed in the FBC Chapter 35 and NFPA 1, Chapter 2 including but not limited to AAMA, ACI, AISC, ANSI, ASCE, ASHRAE, ASTM, FM, GA, OSHA, SJI, USGBC, ADA, IES, and UL standards.

1.5 CODE DISCREPANCIES

A. In case of discrepancy between the codes, standards, and specifications listed, the strictest or most stringent requirement shall govern.

1.6 COMPLIANCE WITH CODES

A. A permit issued will be construed as permission to proceed with construction, and not as authority to violate, cancel, alter, or set aside any of the provisions of any Codes.

B. Nor shall issuance of a permit prevent the Owner from thereafter requiring a correction of errors in plans, construction, or violations of any Codes.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

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SECTION 01 42 00 - REFERENCES

PART 1 GENERAL

1.1 REFERENCE STANDARDS

A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2024.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

E. SSPC-SP 2 - Hand Tool Cleaning; 2024.

F. SSPC-SP 3 - Power Tool Cleaning; 2024.

G. Reference and design standards referenced in Florida Building Code and Florida Fire Prevention Code, 6th Editions are applicable.

H. Documents listed shall be standard references currently in effect at time of project building permitting.

I. American Society of Testing Materials (ASTM):
   1. See individual product specification sections for applicable ASTM standards.

J. American National Standards Institute (ANSI)/Underwriters Laboratories (UL):
   1. See individual product specification sections for applicable ANSI standards.

K. Underwriters Laboratories (UL) - Fire Resistance Directory.

L. Warnock-Hersey - Product Directory.

M. Building Industry Consulting Services International (BICSI):
   1. BICSI-568-2001: Installing Commercial Building Telecommunications Cabling.
   2. BICSI Telecommunications Distribution Methods Manual (TDMM).
   3. BICSI Telecommunications Cabling Installation Manual (TCIM).
      a. BICSI Outside Plant Design Reference Manual, 5th Edition. H FCC (Federal Communications Commission) Rules.

N. FCC (Federal Communications Commission) Rules.

O. National Electrical Code (NEC):
   1. NFPA 70 National Electrical Code, 2008 Edition.

P. National Fire Protection Association (NFPA):
   1. NFPA 101: Life Safety Code - National Fire Protection Association (NFPA).
   2. NFPA 70: National Electrical Code - National Fire Protection Association (NFPA).

Q. Occupational Health and Safety (OSHA): State and Federal Requirements.

R. Telecommunications Industry Association (TIA)/Electronics Industry Association (EIA):
   1. TIA/EIA-568-B.1 and addenda: Commercial Building. Telecommunications Cabling Standard - Part 1: General Requirements.
   2. TIA/EIA-568-B.2 and addenda: Commercial Building Telecommunications Cabling Standard - Part 2: Balanced Twisted-Pair.
   3. TIA/EIA-568-B.2-1: Transmission Performance Specifications for 4-Pair 100 Ohm Category 6 Cabling.
   4. TIA/EIA-568-B.3 and addenda: Commercial Building Telecommunications Cabling Standard - Part 3: Optical Fiber Cabling and Components Standard.

5. TIA/EIA-568-B.3-1: Additional Transmission Performance Specifications for 50/125 ohm Optical Fiber Cables.
6. TIA/EIA-569-A and Addenda: Commercial Building Standard for Telecommunications Pathways and Spaces, CSA T530.
7. TIA/EIA-606-A and Addenda: Administration Standard for Telecommunications Infrastructure of Commercial Buildings, CSA T528.
8. ANSI-J-STD-607-A and Addenda: Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, CSA T530.
9. TIA/EIA-526-7 and Addenda: Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant.
10. TIA/EIA-526-14A and Addenda: Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant.
11. TIA/EIA-758: Customer Owned Outside Plant Telecommunications Cabling Standard.

S. International Electrical Code (IEC):
1. TR3 61000-5-2 - Ed. 1.0 and amendments: Electromagnetic compatibility (EMC) - Part 5: Installation and mitigation guidelines – Section 2: Earthing and Cabling".
2. ISO/IEC 11801: 2000 Edition, 1.2 and amendments: Information Technology – Generic cabling for customer premises.

T. International Standards Organization (ISO/IEC): 11801: 2000 Ed. 1.2 and amendments: Information technology - Generic cabling for customer premises.

U. NACE (National Association of Corrosion Engineers) - Industrial Maintenance Painting.

V. NPCA (National Paint and Coatings Association) - Guide to U.S. Government Paint Specifications.

W. PDCA (Painting and Decorating Contractors of America) - Painting - Architectural Specifications Manual.

X. SSPC (Steel Structures Painting Council) - Steel Structures Painting Manual.
1. SSPC-SP 1 – Solvent Cleaning.
2. SSPC-SP 2 – Hand Tool Cleaning.
3. SSPC-SP 3 – Power Tool Cleaning.
4. SSPC-SP 13 – Nace No 6 Surface Preparation for Concrete.

Y. WDMA (Window and Door Manufacturer's Association) I.S. 1-A-2004.

1.2 DEFINITIONS

A. Communication Definitions:
1. ITS: Information Transport System: Copper cabling or optical fiber for transmission of information on School District property. Transmission includes data, video, voice, fire alarm, security, access control, and other low-voltage networks. Information Transport System is not limited to School District-owned cabling, but includes copper and optical fiber, and equipment owned by outside providers carrying School District's information. Pathways are not limited by School District's ownership, but include those owned by third parties. Information Transport System may be referred to as "the network" within project documents.
2. ICP: Inside Cable Plant: Part of Information Transport System running within buildings. ICP elements include workstation outlet assembly, cabling to the workstation from network rooms, backbone cabling within building, backbone cabling running between physically contiguous buildings, network racks and hardware (routers, switches, hubs, firewalls, etc.), patch panels, punch blocks, fiber distribution panels, patch cords, and cross-connect cables/wires.
3. OCP: Outside Cable Plant: Part of Information Transport System running between buildings, from building to definable exterior point, between definable exterior points, or from non-School District source to School District building or definable exterior point. OCP

includes termination punch blocks, fiber distribution panels, interior splices for outside to inside optical fiber transition, and other initial device into which outside cable attaches. OCP does not include backbone cable running between physically contiguous buildings unless cabling enters OSP pathway element (e.g. OSP conduits, maintenance holes, etc.). OCP includes underground cabling and aerial cabling.

4. Cable: An assembly of one or more insulated conductors or optical fibers, within an enveloping sheath.
5. DP: Dead pairs: Unused copper pairs terminating within splice case, but without being splices to outgoing cable.
6. GP: Grounding electrode: Conductor (rod, pipe or plate or group of conductors) in direct contact with earth for purpose of providing low-impedance connection to earth.
7. GEC: Grounding electrode conductor: Conductor used to connect grounding electrode to equipment grounding conductor, or to grounded conductor of circuit at service equipment, or at source of separately derived system.
8. Handbox: Rectangular or square underground pathway element similar to small maintenance hole, which cannot be fully entered, that allows for pulling point or splice point in power, security or communications pathway.
9. Handhole: A round underground pathway element similar to a handbox, which cannot be fully entered, that allows for a pulling point in a pathway.
10. Identifier: An item of information that links a specific element of the Information Transport System infrastructure with its corresponding record.
11. Infrastructure (Information Transport System): A collection of those Information Transport System components, excluding equipment, that together provides the basic support for the distribution of all information within a building or campus.
12. Linkage: A connection between a record and an identifier or between records.
13. Maintenance (man) holes: Underground pathway element large enough for person to fully enter work, used to provide access to underground cable to pull, splice, and maintain.
14. Media (Information Transport System): Wire, cable, or conductors used for Information Transport System.
15. OB: Outlet box: Metallic or nonmetallic box used to hold Information Transport System outlets/connectors or transition devices.
16. Outlet (Connector) (Information Transport System): Connecting device in work area on which horizontal cable or outlet cable terminates.
17. Pathway: Facility for the placement of Information Transport System cable.
18. Record: Collection of detailed information related to specific element of Information Transport System infrastructure.
19. Report: Presentation of collection of information from various records.
20. Space (Information Transport System): Area used for housing installation and termination of Information Transport System equipment and cable, e.g., equipment rooms, network rooms, work areas, and maintenance holes/handboxes/handholes.
21. Splice: Joining of conductors in splice closure, meant to be permanent.
22. Splice box: Box, located in pathway run, intended to house cable splice.
23. Splice closure: Device used to protect splice.
24. Termination position: Discrete element of termination hardware where information Transport System conductors are terminated.
25. Work Area (work station): Building space where occupants interact with Information Transport System terminal equipment.

B. Painting Definitions:
   1. ASTM D16 - Definitions of Terms Relating to Paint, Varnish, Lacquer, and Related Products for interpretation of terms used herein.

1.3 ABBREVIATIONS AND ACRONYMS

A. Abbreviations noted in Florida Building Code, Chapter 2 are applicable.

B. General Abbreviations:

1. AC: Above Counter/Air Conditioning.
2. ACR: Attenuation-to-Crosstalk Ratio.
3. ADA: Americans with Disabilities Act.
4. AFF: Above finished floor.
5. AFG: Above finished grade.
6. ANSI: American National Standards Institute.
7. ARCH: Architect or Architectural.
8. ASTM: American Society for Testing and Materials (ASTM International).
9. AWG: American Wire Gauge.
10. BD: Building distributor (replacing main-cross connect and MDF as “building service”
    a. room identifiers).
11. BICSI®: Building Industry Consulting Service International, Inc.
12. BTU: British Thermal Unit.
13. CAT6: Category 6 cable.
14. CATV: Community Antenna Television (cable television).
15. CD: Campus distributor (replacing main-cross connect and MDF as “campus-wide service” room identifiers). Also, compact disk for storage of audio or video information.
16. CO: Communications Outlet.
17. COAX: Coaxial Cable.
18. CP: Communications Panel.
19. dB: Decibel.
20. EMS: Energy Management System or Emergency Management System.
21. EMT: Electrical metallic tubing.
22. ENT: Electrical nonmetallic tubing.
23. EDPM: Ethylene-polypropylene-diene membrane.
24. EF: Entrance Facility.
25. EIA: Electronic Industries Alliance.
26. ELFEXT: Equal Level Far-End Crosstalk.
27. EMC: Electromagnetic Compatibility.
28. EMI: Electromagnetic Interference.
29. ER: Equipment Room. Replacing “TR”
30. FMC: Flexible metallic conduit.
31. FCC: Federal Communications Commission.
32. FD: Floor distributor (replacing network room, intermediate and horizontal cross- connect, and telecommunications as “building service” room identifiers). Also, Floor Drain as part of building plumbing system.
33. FDDI: Fiber Distribution Data Interface.
34. FEXT: Far-End Crosstalk.
35. FO: Fiber Optic.
36. Freq: Frequency.
37. GE: Grounding equalizer (replacing TBBIBC).
38. Gnd: Ground.
39. HB: Handbox. Also, hose bibb for water supply part of plumbing system.
40. HC: Horizontal Cross-Connect (replaced by floor distributor “FD”).
41. HH: Handhole.
42. HVAC: Heating, Ventilation, and Air Conditioning.
43. Hz: Hertz.

44. IC: Intermediate Cross-Connect (replaced by building distributor “BD”).
45. IDC: Insulation Displacement Connectors.
46. IDF: Intermediate Distribution Frame (replaced by “BD” or “FD”).
47. IEEE: Institute of Electrical and Electronics Engineers.
48. IMC: Intermediate metal conduit.
49. IN: Inches.
50. ISO: International Organization for Standardization.
51. ISP: Inside Cable Plant.
52. JB: Junction Box.
53. LBS: Pounds.
54. LED: Light Emitting Diode.
55. LFMC: Liquidtight flexible metal conduit.
56. LFNC: Liquidtight flexible nonmetallic conduit.
57. Mbps: Megabits per second.
58. MC: Main Cross-Connect (replaced by campus distributor “CD”).
59. MDF: Main Distribution Frame (replaced by “CD” or “BD”).
60. MER: Main Equipment Room.
61. MH: Maintenance Hole.
62. MHz: Megahertz.
63. NBR: Acrylonitrile-butadiene rubber.
64. NEC: National Electrical Code, NFPA 70.
65. NEMA: National Electrical Manufacturers Association.
66. NESC: National Electric Safety Code, C2-1997.
67. NFPA: National Fire Protection Association.
68. NIC: Not in Contract.
69. NR: Network Room.
70. #: Number.
71. OFCI: Owner Furnished Contractor Installed.
72. OFOI: Owner Furnished Owner Installed.
73. OSHA: Occupational Safety and Health Administration.
74. OCP: Outside Cable Plant.
75. OTDR: Optical Time Domain Reflectometer.
76. PR: Pair.
77. PVC: Polyvinyl Cloride.
78. RCDD®: Registered Communications Distribution Designer.
79. RFI: Radio Frequency Interference.
80. RGC or GRC: Rigid Galvanized Conduit.
81. RH: Relative Humidity.
82. RNC: Rigid nonmetallic conduit.
83. SCS: Structured Cabling System.
84. SS: Stainless Steel.
85. SM: Single Mode.
86. TIA/EIA: Telecommunications Industry Association/Electronic Industry Association.
87. TBB: Telecommunication Bonding Backbone.
88. TBBIBC: Telecommunication Bonding Backbone Interconnecting Bonding Conductor
    a. (replaced by grounding equalizer “GE”).
89. TE: Telephone Equipment (Wall Mounted Equipment Rack).
90. TEL: Telephone.
91. TGB: Telecommunications Grounding Buss bar.
92. TMGB: Telecommunications Main Grounding Buss bar.

93. TR: Telecommunications Room. (Replaced with Main-MDF or Intermediate-IDF Distribution Frame Locations).
94. TYP: Typical.
95. UL: Underwriters Laboratory.
96. UPS: Uninterruptible Power Supply.
97. UTP: Unshielded Twisted Pair.
98. V: Volt.
99. WAO: Work Area Outlet.

1.4 UNITS OF MEASURE

A. Weights and Measures shall be as identified by Weights and Measures Division, NIST, U. S. Department of Commerce, 100 Bureau Dr., Stop 2600, Gaithersburg, MD 20899-2600.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01 42 16 - DEFINITIONS

PART 1 GENERAL

1.1 CONTRACTING DEFINITIONS

A. General: Basic Contract definitions include:
   1. Change Order.
   2. Construction Change Directive.
   3. Contract Documents.
   4. Contract.
   5. Drawings.
   6. Instruments of Service.
   7. Initial Decision Maker.
   8. Project.
   9. Specifications.
   10. Subcontractor.
   11. Substantial Completion.

B. Miscellaneous Other Definitions
   1. Addenda, Addendum.
   2. Alternate Proposal(s).
   3. Approved, Approved Equivalent, Approved Equal, or Equal.
   4. Base Proposal.
   5. Contract Time.
   6. Date of Agreement.
   7. Date of Commencement of the Work.
   8. Date of Final Completion.
   9. Notice to Proceed.
   10. Provide.
   11. Punch List.
   12. Unit Prices.

1.2 DEFINITIONS

A.
   1. AAADM: American Association of Automatic Door Manufacturers.
   2. Accessible: In accordance with the accessibility standard.
   3. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
   4. Activation Device: A control that, when actuated, sends an electrical signal to the door operator to open the door.
   5. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
      a. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
      b. Predecessor Activity: An activity that precedes another activity in the network.
      c. Successor Activity: An activity that follows another activity in the network.
   6. ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines."

7. Adaptable Laboratory Furniture System: Modular furniture assemblies consisting of individual components, including: support structures; cabinets and storage units; worksurfaces; shelving; accessories.
8. Adequate Ventilation: Ventilation, including air circulation and air changes, required for curing materials, dissipate humidity, and prevent accumulation of dust fumes, vapors, or gases.
9. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.
10. AESS: Refer to Architecturally-Exposed Structural Steel.
11. Air Barrier: Airtight barrier made of material that is virtually air impermeable but water vapor permeable, both to amount as specified, with sealed seams and sealed joints to adjacent surfaces.
12. Allowance: A quantity of work or dollar amount included in the Contract, established in lieu of additional requirements, used to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.
13. Alteration Work: Remodeling, renovation, repair, and maintenance work performed within existing spaces or on existing surfaces as part of the Project.
14. Alternate: An amount proposed by bidders and stated on the Bid Form for certain Work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
    a. Alternates described are part of the Work when enumerated in the Agreement. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.
15. Anchorage Connector: A component or subsystem that functions as an interface between the anchorage and a fall protection, work positioning, rope access, or rescue system for the purpose of coupling the system to the anchorage.
16. Architectural Woodwork: Custom millwork that includes wood furring, blocking, shims, and hanging strips for installing woodwork items, unless concealed within other construction before woodwork installation.
17. Architecturally-Exposed Structural Steel (AESS): Structural steel complying with designated AESS category as defined in AISC 303.
    a. Category 1 AESS: AESS that is within 96 inches vertically and 36 inches horizontally of a walking surface and that is visible to a person standing on that walking surface or is designated as "Category 1 architecturally exposed structural steel" or "AESS-1" in the Contract Documents.
    b. Category 2 AESS: AESS that is within 20 feet vertically and horizontally of a walking surface and that is visible to a person standing on that walking surface or is designated as "Category 2 architecturally exposed structural steel" or "AESS-2" in the Contract Documents.
    c. Category 3 AESS: AESS that is not defined as Category 1 or Category 2 or that is designated as "Category 3 architecturally exposed structural steel" or "AESS-3" in the Contract Documents or that is indicated to receive intumescent mastic fireproofing.
18. Approved: The term "approved," when used in conjunction with the Architect's action on the Contractor's submittals, applications, and requests, is limited to the Architect's duties and responsibilities as stated in the Conditions of the Contract.

B.

1. Basis of Design (BOD) (Document): A document that records the concepts, calculations, decisions, and product selections used to meet the Owner’s Project Requirements and to

satisfy applicable regulatory requirements, standards and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

2. Basis of Design (BoD) (Product): A product around which the project has been designed. If a product other than the Basis of Design is provided, it must be coordinated with Architect.
3. Basis of Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "Basis of Design Product", including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other manufacturers named in the specification.
4. Bio-Based Material: Commercial or industrial products (other than food or feed) that are composed in whole, or in significant part, of biological products, renewable agricultural materials (including plant, animal, and marine materials), or forestry materials. For the purposes of LEED, this excludes leather and other animal hides.
5. Boards or Strips: Lumber of less than [2] inches ([50.8] mm) nominal size in least dimension.

C.

1. Casework: Products including, but not limited to framework, doors, drawers, hardware, and finishes which constitute cabinets and cases.
    a. Concealed: Sleepers, web frames, dust panels and other surfaces not generally visible after installation and cabinets less than 30 inches (762 mm) above finished floor. Includes panels and other surfaces not usually visible after installation.
    b. Exposed Portions of Casework: Bottoms of casework more than two feet above floor shall be considered as exposed. Visible members in open cases also shall be considered as exposed portions. Portions of casework visible when drawers and cabinet doors are closed, including end panels, bottoms of cases more than 42 inches (1.066 m) above finished floor, tops of cases less than 72 inches (1.82 m) above finished floor and all members visible in open cases or behind glass doors.
    c. Semi-Exposed Portions of Casework: Portions of casework and surfaces behind solid doors, tops of cases more than 72 inches (1.828 m) above finished floor and bottoms of cabinets more than 30 inches (0.762 m) but less than 42 inches (1.066 m) above finished floor.
2. Cast Stone: Refined architectural concrete building unit manufactured to simulate natural cut stone, used in unit masonry applications.
    a. Dry Cast Concrete Products: Manufactured from zero slump concrete:
        1) Vibrant Dry Tamp (VDT) casting method - Vibratory ramming of earth moist, zero slump concrete against a rigid mold until densely compacted.
    b. Wet Cast Concrete Products: Manufactured from measurable slump concrete:
        1) Wet casting method - Manufactured from measurable slump concrete and vibrated into a mold until densely consolidated.
3. Certified Wood: Wood based materials and products certified in accordance with Forest Stewardship Council’s (FSC) Principles and Criteria for wood building components.
4. Chain-of-Custody Certificates: Certificates signed by manufacturers certifying that wood used to make products was obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001. Certificates shall include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body. A chain-of- custody certification is not required by distributors of a product that is individually labeled with the Forest Stewardship Council logo and manufacturer’s chain of custody number. Chain of Custody certification requirements are determined by Forest Stewardship Council Chain of Custody Standard 40-004 v2-1.
5. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.

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6. CMU: Concrete Masonry Veneer Unit.
7. Commissioning (Cx): A systematic process confirming that building systems have been installed, properly started, and consistently operated in strict accordance with the Project Documents, that all systems are complete and functioning in accordance with the Contract Documents at Substantial Completion, and the Contractor has provided the Owner adequate system documentation and training.
8. Commissioning Authority (CxA): Party having a contractual agreement with the Owner to provide third party commissioning services as defined herein under Commissioning Authority's Role and Responsibilities. Commissioning Authority may represent the Owner and is authorized to act on behalf of the Owner. The Commissioning Authority does not have authority to alter design or installation procedures without the written approval of the Owner or the design team.
9. Comparable Product: Product demonstrated and approved through submittal process, or where indicated as a produce substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
10. Composite Materials: Materials made from two or more constituent materials with significantly different physical or chemical properties that, when combined, produce materials with characteristics different from the individual components.
11. Composite Wood (also referred to as "Engineered Wood"): Examples of Composite Wood are: particleboard; flake-board; plywood; fiberboard; MDF; agrifiber products; millwork substrates; flooring substrates; equipment backboards; door cores.
12. Concealed Portions of Casework: Includes panels and other surfaces not usually visible after installation.
13. Consolidate: To strengthen loose or deteriorated materials in place.
14. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
15. Containment Areas: As determined by Owner's Representative and as shown on drawings. Includes area of construction, adjacent staging and storage areas, for contractors, supplies and waste: includes ceiling spaces above and adjacent to construction, if shown.
16. Contaminant Producing Activities: Activities that include, but are not limited to:
    a. Demolition and removal of walls, floors, ceilings, and other finish materials.
    b. Demolition of plumbing, mechanical and electrical systems and equipment.
    c. Finish operations such as sanding, painting, and application of special surface coatings.
    d. All routine construction activity which can generate dust.
    e. Sitework operations.
17. Contract Documents: The General Conditions, Drawings, Specifications, Addenda, and other documents developed by the A/E Team and approved by the Owner that constitute the contractual obligations of the project scope.
18. Control Point and Sensor Calibration Verification: Process of verifying the point integrity and/or sensor calibration from the physical point of monitoring (sensor, contact, actuator, etc.) to the digital point location at the Operator's interface within the respective control system (Building Automation, Lighting Controls, Power Status and Monitoring, etc.).
19. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum unless otherwise approved by Architect.
20. Cradle-to-Gate Assessment: Analysis of a product's partial life-cycle from extraction (cradle) to gate (factory completion prior to distribution).

21. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
22. Critical Path Method (CPM): A method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
23. Custom Hollow Metal Work: Hollow metal work fabricated according to ANSI/NAAMM-HMMA 861.
24. Cutting: Removal of existing construction necessary to permit installation or performance of other Work.

D.

1. Deconstruct: To remove by disassembling or detaching an item from a surface, using methods and equipment to successfully prevent damage to the item and surfaces, and dispose of items unless indicated as salvaged or for reinstallation.
2. Deferred Testing: Functional Performance or Integrated System Tests performed after Substantial Completion due to partial occupancy, partial equipment acceptance, seasonal requirements, design, or other site conditions that prohibit the test from being performed prior to Substantial Completion.
3. Deficiency: Condition of a component, piece of equipment, or system that is not in compliance with the Project Documents.
4. Demolish: Dismantle, raze, destroy, or wreck any building or structure or any part thereof.
5. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
6. Design Reference Sample: A sample that represents the Architect's prebid selection of Work to be matched; it may be existing Work or Work specially produced for the Project.
7. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's directions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated glass standard.
8. Dimensions: All unit sizes are shown as Nominal Dimensions.
9. Dimension Lumber: Lumber of [2] inches ([50.8] mm) nominal or greater size but less than [5] inches ([127] mm) nominal size in least dimension.
10. Directed: A command or instruction by Architect. Other terms including "requested," "authorized", "selected", "required", and "permitted" have the same meaning as "directed."
11. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; Disposing of items unless indicated to be salvaged or reinstalled.
12. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
13. Double-Egress (Doors): A pair of doors that simultaneously swing with the two doors moving in opposite directions with no mullion between them.
14. Double-Swing (Doors): A pair of doors that swing with the two doors moving in opposite directions with a mullion between them; each door functioning as a single-swing door.
15. Drainable Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

E.

1. Engineered Wood: Refer to Composite Wood.
2. Equipment: A product with operational parts, regardless of whether motorized or manually operated, and in particular, a product that requires service connections such as wiring or piping.

3. Event: The starting or ending point of an activity.
4. Existing to Remain: Leave existing items that are not scheduled for salvage or reuse, as is; Do not remove.
5. Experienced: When used with an entity or individual, experienced means having successfully completed a minimum of five years documented experience with projects similar in nature, size, and extent; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
6. Exposed Portions of Casework: Bottoms of casework more than two feet above floor shall be considered as exposed. Visible members in open cases also shall be considered as exposed portions.

F.

1. Face Size: Actual tile size, excluding spacer lugs.
2. Fall Arrest System: A system designed to stop you in the process of a fall, typically including an anchor point or series of anchor points, a safety lanyard or self-retracting lifeline, and a harness.
3. Fall Protection System: System can be either a fall arrest or a fall restraint system.
4. Fall Restraint System: A system designed to keep you from getting close enough to the fall hazard to fall, typically including an anchor point or series of anchor points, a safety lanyard or self-retracting lifeline, and a harness.
5. Fiber-Reinforced Polymer (FRP): Material that consists of polymer resin-based matrix with fibers of either glass, carbon or aramid, and hybrid combinations of these fiber types.
6. Field Quality Control Testing: Tests and inspections performed onsite for work scheduled to be performed and upon completed Work.
7. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.
8. Float: The measure of leeway in starting and completing an activity.
    a. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
    b. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
    c. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
9. Formaldehyde: Naturally occurring VOC, found in small amounts in animals and plants; carcinogenic and irritant to humans when present in high concentrations. (Levels above 0.1 ppm).
    a. Urea Formaldehyde: Combination of urea and formaldehyde, used in glue, and readily decomposes at room temperature.
    b. Phenolformaldehyde: Type of formaldehyde that off gasses only at high temperature; used for exterior products and suitable for interior applications.
10. Forest Stewardship Council (FSC) Certified Content: Permanently installed wood content that has been harvested in accordance from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship." Recycled wood fiber that qualifies as contributing to MR Credit 4 (Recycled Content) is excluded from FSC Certified Content.
11. Furnish: The term "furnish" means to supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
12. Functional Performance Test (FPT): Test of dynamic function and operation of equipment and systems executed by the Contractor and witnessed by the CxA. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component

failures, unoccupied, varying outside air temperatures, life safety conditions, power failure, etc. Systems are operated through all specified sequences of operation. Components are verified to be responding in accordance with requirements in the Project Documents.

13. Functional Performance Testing Procedures: Commissioning protocols, detailed test procedures and instructions in tabular and script-type format that fully describe system configuration and steps required to determine if the system is performing and functioning properly.
14. Furnish: Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G.

1. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
2. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
3. General: Considering or including the main features or elements of something, and disregarding exceptions; overall.
4. General Emissions Evaluation: To comply with low-emitting material criteria, building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.2–2017mg/, using the applicable exposure scenario. Manufacturers' claims of compliance with the above requirements must also state the range of total VOCs after 14 days (336 hours), measured as specified in the CDPH Standard Method v1.2: 0.5 mg/m3 or less; between 0.5 and 5.0 mg/m3; or 5.0 mg/m3 or more.

H.

1. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.
2. Hazardous Materials: Material regulated as hazardous material in accordance with 49 CFR 173, requiring Material Safety Data Sheet (MSDS) in accordance with 29 CFR 1910.1200, or which during end use, treatment, handling, storage, transportation, or disposal meets or has components which meet or have the potential to meet the definition of a Hazardous Waste in accordance with 40 CFR 261. Hazardous material includes hazardous chemicals.
3. Hazardous materials include but are not limited to pesticides, biocides, and carcinogens listed by the Environmental Protection Agency (EPA) and International Agency for Research on Cancer (IARC) and recognized authorities.
4. Horizontal Louver: Louver with horizontal blades (i.e., the axes of the blades are horizontal).

I.

1. IBC: International Building Code.
2. Indicated: Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown", "noted", "scheduled", and "specified" have the same meaning as "indicated."
3. Indoor Air Quality (IAQ): Composition and characteristics of air in an enclosed space affecting occupants of space. The indoor air quality refers to relative quality of air in a building with respect to contaminants and hazards and is determined by levels of indoor air pollution and characteristics of air, including those that impact thermal comfort such as air temperature, relative humidity, and air speed.
4. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

5. Integrated Systems Test (IST): Test of dynamic function and operation of multiple systems. Integrated Systems Tests are tested under various modes, such as fire alarm and emergency situations, life safety conditions, power failure, etc. Systems are integrally operated through all specified sequences of operation. Systems and interconnections are verified to be responding in accordance with the requirements in the Project Documents.
6. Integrated Systems Testing Procedures: Commissioning protocols and detailed test procedures and instructions in tabular and script-type format that fully describe system configurations and steps required to determine if the interacting systems are performing and functioning properly.
7. Interior Final Finishes: Materials and products exposed at interior, occupied spaces including flooring, wallcovering, finish carpentry, and ceilings.
8. Install: Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
9. Installer/Applicator/Erector: Contractor or another entity engaged by Construction Manager as an employee, Subcontractor, or Sub-subcontractor, to perform particular construction operations, including installation, erection, application, and similar operations.
    a. The term "experienced," when used with the term "installer," means having successfully completed a minimum of 5 previous projects similar in size and scope to this Project; being familiar with the special requirements indicated; and having complied with requirements of authorities having jurisdiction.
    b. Trades: Using terms such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.
    c. Assigning Specialists: Certain Sections of the Specifications require that specific construction activities shall be performed by specialists who are recognized experts in those operations. The specialists must be engaged for those activities, and their assignments are requirements over which the Contractor has no option. However, the ultimate responsibility for fulfilling contract requirements remains with the Contractor.
        1) This requirement shall not be interpreted to conflict with enforcing building codes and similar regulations governing the Work.
10. Interior (of Building): Within the weatherproof membrane.
11. Interspace: Space between lites of an insulating-glass unit.

J.

N/A

K.

1. Knowing act: Consciously initiating the opening of a power operated door using acceptable methods including wall mounted switches such as push plates and controlled access devices such as keypads, card readers and key switches.

L.

1. Lead Equivalence: The thickness of lead that provides the same attenuation (reduction of radiation passing through) as the material in question under the specified conditions.
2. Leadership in Energy and Environmental Design (LEED): USGBC's Building Rating System
    a. Refer to the applicable LEED Reference Guide for additional definitions.
3. LEED Online: GBCI’s online portal for project certification documentation.
4. LEED Project Administrator: Responsible for administration of LEED Certification Application.
5. Life-Cycle Inventory: Database that defines environmental input and output for each step in a material or assembly's life cycle.

6. Lifeline: A component of a fall protection system consisting of a flexible line designed to hang vertically, a vertical lifeline, or connecting to anchorages or anchorage connectors at both ends to span horizontally, a horizontal lifeline.
7. List of Incomplete Items: Contractor-prepared list of items to be completed or corrected, prepared for the Architect's use prior to Architect's inspection, to determine if the Work is substantially complete.
8. Look-Ahead Schedule: Prepare schedule indicating activities scheduled to occur or commence prior to submittal of next schedule update.
9. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

M.

1. Match: To blend with adjacent construction and manifest no apparent difference in material type, species, cut, form, detail, color, grain, texture, or finish; as approved by Architect.
2. Materials: Products which must be substantially cut, shaped, worked, mixed, finished, refined, or otherwise fabricated, processed, or installed to form units of work.
3. MERV: Minimum Efficiency Reporting Value: Arrestance rating of filter at three MERV Rating Explanation particle sizes of 0.3 microns to 10 microns at a determined face velocity.
4. Milestones: measurable and observable and serve as progress markers (flags) but, by definition, are independent of time (have zero durations) therefore no work or consumption of resources is associated with them.
5. Millwork: Ready-made wood products manufactured at a wood-planing mill or woodworking plant: moldings, doors, door frames, window sashes, stair work, cabinets, etc. excluding flooring, ceilings, and sidings.
6. Mineral Fiber Material Composition: Insulation referred to as mineral fiber block, board, and blanket insulation is composed of fibers from mineral based substances such as rock, slag, or glass and processed from the molten state into fibrous form.
    a. Based on type of insulation substance, the material will be referred to as a mineral fiber when having a rock or slag base, and glass fiber with a glass or silica sand base, also considered a mineral.
    b. Insulation blankets are flexible units consisting of felted, bonded, or unbonded fibers formed into rolls or flat cut pieces referred to as batts; rolls are simply longer versions of batts.
    c. For additional information about mineral fiber and the various classification types, refer to the following reference standards; ASTM C553, ASTM C612, ASTM C665, and ASTM C726.
7. Minimum Thickness: Minimum thickness of base metal without coatings.
8. “Minor” ceiling access is defined as visual observation or minor adjustments or other activity that does not disturb dust. Acoustical panels shall be replaced or access panel shall be closed immediately when the contractor leaves the work site.
    a. “Major” ceiling access describes any other access not defined as “minor”.
9. Mobile Cabinet: Free-standing base cabinet storage device mounted on casters or glides.
10. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
    a. Laboratory Mockups: Full-size physical assemblies constructed at testing facility to verify performance characteristics.

b. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
c. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.

11. Module Size: Actual tile size plus joint width indicated.

N.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
2. Negative Air Machine: Portable mechanical units to provide a negative air pressure in the Containment Areas.
3. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
4. Non-Hazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.
5. Non-Toxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.

O.

1. Operational Testing: Activities and testing occurring after initial energizing and/or start-up of equipment that determine whether equipment is operating within the manufacturer’s recommendations and the design requirements. These activities are intended to ensure that equipment and systems meet all warranty requirements and are ready for Functional Performance Testing. Common examples are Testing, Adjusting and Balancing of HVAC systems and initial load testing of electrical equipment.
2. Owner's Designated Representative (ODR): Owner’s representative, or its duly authorized representative, who will provide the general administration of this Agreement for Projects on behalf of Owner and shall be Owner’s field representative in all matters related to this Agreement, including keeping Owner’s procurement personnel informed at all times of the adequacy of Supplier’s performance and progress, except as may be otherwise provided herein. Owner may, at its sole discretion, change its Designated Representative at any time or from time to time, and shall promptly notify Supplier, in writing, of any such change.
3. Owner’s Project Requirements (OPR): A written document that details the functional requirements of a project and the expectations of how the facility will be used and operated. These include project goals, measurable performance criteria, cost considerations, benchmarks, success criteria and supporting information.

P.

1. Packaged Dry Products: Materials and products installed in dry form and delivered in manufacturer's packaging; including carpets, resilient flooring, ceiling tiles, and insulation.
2. Patching: Fitting and repair Work required to restore surfaces to original conditions after installation of other Work.
3. Pencil Copy: A preliminary review copy of the application for payment for review by Architect and Owner prior to submission of final copy.
4. Permanent Enclosure: As determined by Architect, permanent or temporary roofing is complete, insulated, and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures.
5. Permeable Surface: Surfaces which allow storm water to pass through and infiltrate the soil below.

6. Plastic Composites, or Wood-Plastic Composites: Composite materials made primarily from wood- or cellulose-based materials and plastics.
7. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.
8. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.
9. Product: Item obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term “product” includes the terms “material”, “equipment”, “system”, “assembly”, and terms of similar intent.
    a. Comparable Product: A product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
    b. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature current as of date of the Contract Documents.
    c. Specified Products: Same as Named Products.
    d. New Products: Items that have not previously been incorporated into another project or facility, except products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
10. Project Documents: Consists of the Contract Documents, Approved Submittals, Requests for Information (RFI), Vendor documentation, Operations and Maintenance (O&M) information and other documentation that determines the requirements for acceptable installation and operation of the specific equipment and systems on the project.
11. Project Site: Space available to the Contractor for performing construction activities, either exclusively or in conjunction with others performing work as part of the Project. The extent of the Project site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.
12. Protection Areas: As determined by Owner’s Representative and as shown on drawings as Protection areas. Includes hospital areas adjacent to Containment Area, either occupied or used for passage, as well as areas connected to construction area by mechanical system air intake, exhaust and ductwork.
13. Provide: Furnish and install, complete and ready for the intended use.

Q.

1. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
2. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

R.

1. Rapidly Renewable Materials: Materials and products made from plants that are typically harvested within a 10-year or shorter cycle.
2. Recovery Schedule: Submittal of a revised critical path method (CPM) schedule and a written plan.
3. Recyclable: Ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.

4. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
5. Recycled Content: Defined in accordance with the International Organization of Standards document ISO 14021, Environmental labels and declarations, Self-declared environmental claims (Type II environmental labeling). The percentage by weight of constituents that have been recovered or otherwise diverted from the solid waste stream, either during the manufacturing process (pre- consumer), or after consumer use (post-consumer).
    a. Preconsumer material is defined as material diverted from the waste stream during the manufacturing process.
        1) Discarded materials from one manufacturing process that are used as constituents in another manufacturing process are pre-consumer recycled materials.
        2) Excluded is reutilization of materials, such as rework, regrind, or scrap, generated in a process and capable of being reclaimed within the same process that generated it; Spills and scraps from the original manufacturing process that are combined with other constituents after a minimal amount of reprocessing for use in further production of the same product are not recycled materials.
    b. Postconsumer material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
6. Recycling: Process of sorting, cleansing, treating, and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
7. Refinish: To remove existing finishes to base material and apply new finish to match original, or as otherwise indicated.
8. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles (160 km) of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.
    a. Green Globes requirement for Regionally Extracted, Harvested, or Recovered Materials: Materials that are extracted, harvested, or recovered and manufactured within a radius of [500] miles ([804.67] kilometers) from the Project site.
    b. Green Globes requirements for Regionally Manufactured Materials: Materials that are manufactured within a radius of [500] miles ([804.67] kilometers) from the Project location. Manufacturing refers to the final assembly of components into the building product that is installed at the Project site.
9. Regulations: Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
10. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.
11. Remove: Detach items from existing construction and dispose off-site unless indicated as salvaged or reinstallation.
12. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage. Clean, package, label and deliver salvaged items to Owner in ready-for-reuse condition.
13. Remove and Reinstall: Detach or dismantle items from existing construction in a manner to prevent damage. Clean and prepare for reuse and reinstall where indicated.
14. Repair: To correct damage and defects, retaining existing materials, features, and finishes. This includes patching, piecing-in, splicing, consolidating, or otherwise reinforcing or upgrading materials.
15. Replace: To remove, duplicate, and reinstall entire item with new material. The original item is the pattern for creating duplicates unless otherwise indicated.
16. Replicate: To reproduce in exact detail, materials, and finish unless otherwise indicated.

17. Reproduce: To fabricate a new item, accurate in detail to the original, and from either the same or a similar material as the original, unless otherwise indicated.
18. Request for interpretation (RFI): A request seeking one of the following:
    a. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
    b. A resolution to an issue which has arisen due to field conditions and affects design intent.
19. Resource Loading: The allocation of manpower and equipment necessary for completion of an activity as scheduled.
20. Retain: To keep existing items that are not to be removed or dismantled.
21. Return: To give back reusable items or unused products to vendors for credit.
22. Reuse: To reuse a construction waste material in some manner on the project site.
23. Reviewed: When used to convey Architect's action on Contractor's submittals, applications, and requests, "reviewed" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

S.

1. Safety Device: A device that detects the presence of an object or person within a zone where contact could occur and provides a signal to stop the movement of the door.
2. Salvage: Recovery of demolition or construction waste for subsequent sale or reuse.
3. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.
4. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.
5. Scheduling Specialist (SS): An internal or third party entity contracted to the Owner providing scheduling advice (if applicable).
6. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.
7. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.
8. Semi-Exposed Portions of Casework: Include those members such as divisions, interior faces of ends, case back, backs and bottoms.
9. Solar Reflectance Index (SRI): The measure of a constructed surface's ability to stay cool in the sun by reflecting solar radiation and emitting thermal radiation. SRI values range from zero (solid black surface) to 100 (solid white surface). SRI value of a material is calculated according to ASTM E1980 and based on the aged, tested values of solar reflectance and thermal emittance.
10. Source Separation: Separating waste materials from the time they become waste.
11. Specified Products: Products listed as to be supplied as specified.
12. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.
13. Start-Up: The activities where equipment is initially energized, tested and operated. Start-up is completed prior to Operational Testing and Functional Performance Testing and is an integral item documented in the System Verification Checklist (SVC).
14. Strip: To remove existing finish down to base material unless otherwise indicated.
15. Submittals: Written and graphic information and physical samples that require Architect's responsive action or are for information and do not require the architect’s action.
16. Substitutions: Changes from the Contract Document requirements proposed by the CONTRACTOR after the award of the Contract. Changes include products, assemblies,

materials, equipment, and methods of construction. Proposed substitutions by the CONTRACTOR are considered to be requests for substitutions. Substitutions will be considered by the OWNER as a special request.

a. Substitutions for Cause: Proposed substitutions due to changed Project circumstances beyond Contractor's control, such as product unavailability, unavailability of required warranty terms, or regulatory changes.
b. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements, but may offer advantage to Contractor or Owner.
c. The following are not considered to be requests for substitutions:
    1) Substitutions requested during the bidding period, and accepted by Addendum prior to award of the Contract, are included in the Contract Documents and are not subject to requirements for substitutions listed in Section "Substitution Procedures."
    2) Revisions to the Contract Documents requested by the OWNER.
    3) Specified options of products and construction methods included in Contract Documents.
    4) The CONTRACTOR'S determination of and compliance with governing regulations and orders issued by governing authorities.

17. Subsystem: A portion of a system with characteristics similar to a system.
18. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
19. System Verification Checklist (SVC): List of static inspections and material or component tests that verify proper installation of equipment (e.g., belt tension, oil levels, labels affixed, gages in place, sensors calibrated, etc.), start-up activities and documentation, as well as operational testing results. The checklists are meant to document all activities for an individual piece of equipment from procurement on the project through operational testing are performed in accordance with the requirements in the project documents.

T.

1. Testing:
    a. Field Quality Control Testing: Tests and inspections performed on site for installation of the Work and for completed Work.
    b. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
    c. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
    d. Source Quality Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
2. Testing Agency/Testing Agencies: Independent entity(ies) engaged to perform specific inspections, tests, or both, either at the Project Site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.
3. Testing Laboratory: Refer to Testing Agency.
4. “Thorough” cleaning of surfaces: Cleaning of surfaces which become exposed to dust shall be accomplished by the use of either a HEPA filtered vacuum cleaner or a wet mop.
5. Toxic: Poisonous to humans either immediately or after a long period of exposure.
6. Training Plan: A detailed plan prepared by the Contractor and reviewed by the Owner and Commissioning Authority that outlines the training activities, instructors, time durations, and system requirements in accordance with the Contract Documents and Commissioning Plan.

7. Trending: Data collection of monitored points using the Building Automation System, Lighting Controls System, Power Status and Monitoring System or independent data acquisition instrumentation.

U.

1. Unit price is an amount incorporated into the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

V.

1. Vapor Retarder: Airtight barrier made of material that is relatively water vapor impermeable, to degree specified, with seams and joints sealed to adjacent surfaces.
2. Vapor Retarder Class: A measure of a material or assembly's ability to limit the amount of moisture that passes through that material or assembly. Vapor retarder class is defined using Procedure A, Desiccant Method at 73 degrees F (23 degrees C) and 50 percent Relative Humidity (RH), in accordance with ASTM E96/E96M and ICC (IBC)-2018, as follows:
   a. Class I: 0.1 perm or less.
   b. Class II: Greater than 0.1 perm to 1.0 perm.
   c. Class III: Greater than 1.0 perm to 10 perms.
   d. Vapor Permeable: 5 perms or greater.
3. Vertical Illuminance: Illuminance levels calculated at a point on a vertical service or plane.
4. Vertical Louver: Louver with vertical blades (i.e., the axes of the blades are vertical).
5. Visual Display Board Assembly: Visual display surface that is factory fabricated into composite panel form, either with or without a perimeter frame.
6. Visual Display Surface: Surfaces that are used to convey information visually, including surfaces of markerboards and surfacing materials that are not fabricated into composite panel form but are applied directly to walls.
7. Volatile Organic Compound (VOC): A carbon compound that vaporizes at normal room temperatures.

W.

1. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.
2. Wet Products: Materials and products installed in wet form, including paints, sealants, adhesives, and special coatings.
3. Wind Driven Rain Resistant Louver: Louver that provides specified wind driven rain performance determined by testing according to AMCA 500-L.
4. Wood-Plastic Composites: Refer to Plastic Composites.
5. Work Package: A group of specifications, drawings, and schedules prepared by the design team to describe a portion of the Project Work for pricing, permitting, and construction.
6. WRB: Water Resistive Barrier.

X.

N/A

Y.

N/A

Z.

N/A

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01 45 00 - TESTING LABORATORY SERVICES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, materials, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Selection and payment.
   2. Quality Assurance.
   3. Laboratory reports.
   4. Limits on testing laboratory authority.
   5. Testing.
   6. Welding and Quality Control.
   7. Bolted Structural Connections Quality Control.

1.3 REFERENCE STANDARDS

A. 29 CFR 1910.7 - Definition and Requirements for a Nationally Recognized Testing Laboratory, Current Edition.

B. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field; 2024.

C. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation; 2026.

D. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2023.

E. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2025b.

1.4 REFERENCES

A. Refer to specification Section 014100 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SELECTION AND PAYMENT

A. Owner will employ and pay for services of an independent testing laboratory to perform specified inspection and testing.

B. Employment of testing laboratory shall in no way relieve Construction Manager of obligation to perform work in accordance with requirements of Contract Documents.

C. Retest Responsibility: Where results of required inspection, test, or similar service are unsatisfactory (do not indicated compliance of related work with requirements of Contract Documents), retests are responsibility of the Contractor. Retesting of work revised or replaced by the Contractor is the Contractor's responsibility, where required tests were performed on original work.
   1. Arrange with laboratory and pay for additional samples and tests required by Construction Manager beyond specified requirements and pay compensation for Architect's additional services made necessary by failed tests and inspections.

1.6 SUBMITTALS

A. Schedule of Tests and Inspections: Prepare and submit in tabular form and include the following:
   1. Specification section number and title.

2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

B. Testing service will submit two (2) copies of test reports directly to the Architect from the testing service, with one copy to the Construction Manager.

1.7 QUALITY ASSURANCE

A. Laboratory, authorized to operate in State of Florida.

B. Laboratory maintains a full time registered Engineer on staff to review services.

C. Testing Equipment, calibrated at reasonable intervals with devices of accuracy traceable to either National Bureau of Standards (NBS) Standards or accepted values of natural physical constants.

D. Laboratory: Conform to applicable requirements of ASTM C1077 and ASTM E329. Meet "Recommended Requirements for Independent Laboratory Qualifications", published by American Council of Independent Laboratories.

E. Personnel: Minimum of two (2) years experience performing testing that meets requirements of these Specifications. Agent of laboratory performing field sampling and field testing of concrete shall be certified by the American Concrete Institute (ACI) as a Concrete Field Testing Technician Grade 1, by an equivalent recognized national authority for an equivalent level of competence, or shall be a licensed Professional Engineer.

1.8 LABORATORY REPORTS

A. Testing service is required to immediately notify Architect of discrepancies observed in the Work performed and to be performed in accordance to the Contract Documents.

B. After each inspection and test, submit 2-copies of laboratory report to Owner, Architect, and Construction Manager.

C. Provide where required by Specification Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee

payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.9 LIMITS ON TESTING LABORATORY AUTHORITY

A. Laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.

B. Laboratory may not approve or accept any portion of the Work.

C. Laboratory may not assume any duties of Construction Manager.

D. Laboratory has no authority to stop the Work.

1.10 TESTING

A. Construction Manager Responsibilities:
   1. Notify testing agencies at least twenty-four (24) hours in advance of time when Work that requires testing or inspecting will be performed.
   2. Deliver to laboratory at designated location, adequate samples of materials used, which require testing, along with proposed mix designs.
   3. Cooperate with laboratory personnel, and provide access to the Work and to manufacturer's facilities.
   4. Provide incidental labor and facilities to provide access to Work to be tested, to obtain, and handle samples at the site or at source of products to be tested, to facilitate tests and inspections, storage and curing of test samples.
   5. Where quality-control services are indicated as Construction Manager's responsibility, submit a certified written report, in duplicate, of each quality-control service.
   6. Testing and inspecting requested by Construction Manager and not required by the Contract Documents are Construction Manager's responsibility.
   7. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
   8. Employ and pay for the services of Testing Laboratory to perform additional inspections, sampling and testing required:
      a. For the Construction Manager's convenience.
      b. When initial tests indicate work does not comply with Contract Documents.
      c. Make arrangements with Laboratory and pay for additional samples and tests required for Construction Manager's convenience.
   9. Do not place or install any material which does not meet specified requirements. Do not place or install any material over or on a substrate that has not met test requirements.

B. Testing Agency Responsibilities: Cooperate with Architect, Commissioning Authority, and Construction Manager in performance of duties. Provide qualified personnel to perform required tests and inspections.
   1. Notify Architect, Commissioning Authority, and Construction Manager promptly of irregularities or deficiencies observed in the Work during performance of its services.
   2. Cooperate with Architect, Engineer and Construction Manager; provide qualified personnel after due notice.
   3. Perform specified inspections, sampling and testing of materials and methods of construction.
      a. Comply with specified standards.
      b. Ascertain compliance of materials with requirements of Contract Documents.
      c. Utilize properly calibrated equipment, calibrated within past twelve (12) months by devices of accuracy conforming to National Bureau of Standards or within accepted values of natural physical constants.
   4. Perform additional test(s) as required by Architect or Owner.
   5. Submittals: Submit qualifications of technicians, inspectors, engineers, and the organization to perform services for this Project. Include copies of certificates and license numbers to confirm compliance.

6. Keep time and cost separate for additional testing and inspection as outlined herein. Notify the Architect of additional testing and inspection required.
7. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
8. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
9. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Construction Manager.
10. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
11. Do not perform any duties of Construction Manager.
12. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
    a. Schedule times for tests, inspections, obtaining samples, and similar activities.
    b. Testing requirements indicated in specific specification sections shall take precedence over testing requirements indicate in this section which relate to the same specific specification section.
13. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Construction Manager's quality-control plan. Coordinate and submit concurrently with Construction Manager's construction schedule. Update as the Work progresses.
    a. Distribution: Distribute schedule to Owner, Architect, Commissioning Authority, Construction Manager, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.11 PRECONSTRUCTION TESTING

A. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
    1. Construction Manager responsibilities include the following:
        a. Provide test specimens representative of proposed products and construction.
        b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
        c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
        d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
        e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
        f. When testing is complete, remove test specimens, assemblies, and mockups; do not reuse products on Project.
    2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect and Commissioning Authority, with copy to Construction Manager.

1.12 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency or special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:

B. Special Tests and Inspections: Conducted by a qualified testing agency or special inspector as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:
   a. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
   b. Notifying Architect and Construction Manager promptly of irregularities and deficiencies observed in the Work during performance of its services.
   c. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Construction Manager and to authorities having jurisdiction.
   d. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
   e. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
   f. Retesting and reinspecting corrected work.
   g. Special Testing or Inspections required:
      1) Test No. 1
      2) Inspection No. 1.

1.13 SOIL COMPACTION TESTING

A. The Construction Manager for the work of specification section “Earthwork”, shall coordinate with soil testing and inspection service for quality control testing during earthwork operations and shall follow testing required in the Earthwork section and if none is indicated provide the following:
   1. Field density test reports
   2. One optimum moisture-maximum density curve for each type of soil encountered or utilized.
   3. The Construction Manager shall cooperate and coordinate with Soils Engineer to be on the site for observation and testing during times when the following operations are being performed.
      a. Proofrolling
      b. Compaction of areas of subgrades and fill. During compaction operations, the Soils Engineer shall also carefully monitor existing foundations to detect possible foundation movements. If movement is detected, Work shall be stopped and the Architect immediately notified.

B. Quality Control Testing During Construction: Testing service must inspect and approve subgrades and fill layers before further construction work is performed thereon. Tests of subgrades and fill layers will be taken as follows:
   1. Footing Subgrade: For each strata of soil on which footings will be placed, conduct at least one test to verify required design bearing capacities. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested strata, when acceptable to Architect, except that a minimum of one test shall be performed for each 15,000 square feet of building area.
   2. Building Slab Subgrade: Make at least one field density test of subgrade for every 2,000 square feet of building slab, but in no case less than 3 tests. In each compacted fill layer, make one field density test for every 2,000 square feet of overlaying building slab area, but in no case less than 3 tests.
   3. Foundation and Retaining Wall Backfill: Take at least 2 field density tests, at locations and elevations as directed.
   4. Paved Areas: Make at least one field density test of the subgrade for every 2,000 square feet, or portion thereof, of paved area, but in no case less than 3 tests shall be made for each day’s final compaction operations. On each compacted fill layer, make at least one field density test for every 2,000 square feet, or portion thereof, of overlaying paved area, but in no case less than 3 tests shall be made for each day’s final compaction operations. When stabilized subgrade is indicated on the Drawings, make at least one Limerock Bearing

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Ratio test of the subgrade for every 2,000 square feet, or portion thereof, but in no case less than 3 test shall be made for each day's final stabilizing operations.

5. Stabilized Shoulders: Make at least one field density test for every 200 lineal feet, or portion thereof, of stabilized shoulders staggered every 100 feet on either side of the roadway, but in no case less than 3 tests shall be made for each day's final compaction operations. Make at least one Limerock Bearing Ratio test for every 200 lineal feet, or portion thereof, of stabilized shoulders staggered every 100 feet on either side of the roadway, but in no case less than 3 tests shall be made for each day's final stabilizing operations.
6. Potable Water, Sanitary Sewer and Storm Drain Pipe Trench Backfill: Make at least one field density test on each 12" layer (lift) of trench backfill from the top of the pipe to the bottom of the subgrade or finished ground, as appropriate.
    a. As a minimum, provide at least one test for each 12" layer, for every 200 lineal feet or portion thereof of pipe trench.
    b. In addition, provide at least one test for each 12" layer, for every section of sanitary/storm pipe trench between structures.
    c. In addition, provide at least one test for each 12" layer, for every pipe trench crossing an existing or proposed road perpendicular to the centerline of the road.

C. If, in the opinion of the Architect, based on reports of testing service and inspection, subgrade or fills which have been placed are below specified density, additional compaction work and testing shall be provided by the Construction Manager for the Section of Work involved at no additional expense, until subgrades or fills meet or exceed specified density.

1.14 ASPHALTIC CONCRETE PAVEMENT TESTING

A. The Construction Manager for the Work of specification section "Asphaltic Concrete Pavement", shall coordinate with a separate testing laboratory to perform field quality control and shall follow testing required in the Asphaltic Concrete section and if none is indicated provide the following:

B. Test uncompacted asphalt concrete mix and report the following:
1. Sampling: AASHTO T168 (ASTM D979) and F.D.O.T. Specifications.
2. Asphalt Cement Content: AASHTO T164 (ASTM D2172) and F.D.O.T. Specifications.
3. Perform at least one initial test for paving, unless otherwise specified or directed.

C. Test in-place, compacted pavement for density and thickness, as specified. Perform one test for each 2,000 square feet but not less than one test per day, unless otherwise specified or directed.

D. The Construction Manager shall pay for and perform additional Work and testing as may be required if any of the previous tests indicate insufficient values or if directed by the Architect. Continue Work and testing until specified values have been attained.

E. Asphalt concrete material not complying with specified requirements will not be acceptable. The Construction Manager shall repair or remove and replace defective paving as directed by the Architect, at no additional cost to the Owner.

F. Record the locations where samples are taken to correlate with subsequent testing.

1.15 CONCRETE TESTING

A. The Construction Manager for the Work of Specification Section "Cast In Place Concrete", shall coordinate with a separate testing laboratory to perform field quality control testing during concrete work under Division 3 and shall follow testing required in the Cast-In-Place Concrete section and if none is indicated provide the following:

B. Quality Control Testing During Construction: Perform sampling and testing for field quality control during the placement of concrete, as follows:
1. Sampling Fresh Concrete: ASTM C172, except modified for slump to comply with ASTM C94.
2. Slump: ASTM C143, one test for each concrete load at point of discharge, and one for each set of compressive strength test specimens.

3. Air Content: ASTM C23l, pressure method; one for every other concrete load at point of discharge or when the indication of change requires.
4. Compression Test Specimens: ASTM C31, one set of 6 standard cylinders for each compressive strength test, unless otherwise directed.
    a. Cast and store 3 cylinders for laboratory cured test specimens and 3 field-cured test specimens as specified in ASTM C31.
    b. Concrete Temperature: Test hourly when air temperature is 40 degrees F. and below and when 80 degrees F. and above; and each time a set of compressive test specimens is made.
5. Compressive Strength Tests: ASTM C39, one set for each 50 cu.yds. or fraction thereof, of each mix design placed in a day or for each 5,000 sq.ft. of surface area placed; 2 specimens (one field cured and one lab cured) tested at 7 days, 2 specimens (one field cured and one lab cured) tested at 28 days, and 2 specimens (one field cured and one lab cured) retained in reserve for later testing if required.
    a. When the frequency of testing will provide less than 5 strength tests for a given mix design, conduct testing strength tests for a given mix design, conduct testing from at least 5 randomly selected batches or from each batch if fewer than 5 are used.
    b. When the strength of field cured cylinders is less than 85 percent of companion laboratory cured cylinders, evaluate current operations, and provide corrective procedures for protecting and curing the in-place concrete.
6. Report test results in writing to the Architect, Engineer, Construction Manager, and ready mix supplier on the same day that tests were made. Reports of compressive strength tests shall contian the porject idenfification name and number, date of concrete placement, name of construction manaager, name of concrete suppllier and truck number, name of concrete testing service, concrete type and class, location of concrete batch in the structure, design compressive strength at 28 days, concrete mix proportions and materials, type and amount of fiberous reinforcement, compressive breaking strength, and type of break for both 7 day tests and 28 day tests.
    a. Compressive strength tests for laboratory-cured cylinders will be considered satisfactory if the averages of all sets of three consecutive compressive strength tests results equal or exceed the 28 day design compressive strength of the type or class of concrete; and no individual strength test falls below the required compressive strength by more than 500 psi.
    b. Strength tests of specimens cured under field conditions may be required by the Architect to check the adequacy of curing and protecting of the concrete placed. Specimens shall be molded by the field quality control laboratory at the same time and from the same samples as the laboratory cured specimens.
        1) Provide improved means and procedures for protecting concrete when the 28 day compressive strength of field cured cylinders is less than 85 percent of companion laboratory cured cylinders.
        2) When laboratory cured cylinder strengths are appreciably higher than the minimum required compressive strength, field cured cylinder strengths need not exceed the minimum required compressive strength by more than 500 psi even though the 85 percent criterion is not met.
        3) If individual tests of laboratory cured specimen produce strengths more than 500 psi below the required minimum compressive strength or if tests of field cured cylinders indicates deficiencies in protection and curing, provide additional measures to assure that the load-bearing capacity of the structure is not jeopardized. If the likelihood of low-strength concrete is confirmed and computations indicate the load-bearing capacity may have been significantly reduced, tests of cores drilled from the area in question may be required.

(a) If the compressive strength tests fail to meet the minimum requirements specified, the concrete represented by such tests will be considered deficient in strength.

1.16 CONCRETE MATERIALS AND MIX DESIGN TESTING

A. CONCRETE MATERIALS AND MIX DESIGN
   1. Ready-mixed concrete shall be mixed and delivered in accordance with ASTM C94.
   2. Product Data: Submit 2 copies of manufacturer's specifications with application and installation instructions for proprietary materials and items, including admixtures, bonding agents, waterstops, joint systems, chemical floor hardeners, and dry shake finish materials.
   3. Laboratory Test Reports: Submit 2 copies of laboratory test reports for concrete materials and mix design tests. The Architect's review will be for general information only. Production of concrete to comply with specified requirements is the Construction Manager's responsibility.
   4. Mix Design: Submit 6 copies of concrete mix designs for each type of mix required by the Concrete Schedule indicating the amount of each ingredient (by weight) in one cubic yard of concrete, the calculated water/cement ratio, and the slump.
      a. Tests for Concrete Materials
   5. For normal weight concrete, test aggregates by the methods of sampling and testing of ASTM C33.
   6. For lightweight concrete, test aggregates by the methods of sampling and testing of ASTM C330.
   7. For portland cement, sample the cement and determine the properties by the methods of test of ASTM C33.

B. Submit written reports for each material sampled and tested, prior to the start of Work. Provide the project identification name and number, date of report, name of Construction Manager, name of concrete testing service, source of concrete aggregates, material manufacturer and brand name for manufactured materials, values specified in the referenced specification for each material, and test results. Indicate whether or not material is acceptable for intended use.

1.17 WELDING QUALITY CONTROL

A. Welding operators shall be qualified under the provisions of the AWS Structural Welding Code, on test pieces in positions and with clearances equivalent to those actually to be encountered in construction and shall follow testing required in the applicable section and if none is indicated provide the following;

B. Welds requiring inspection shall be so indicated in the drawings.
   1. Welds indicted as requiring visual inspection shall be visually inspected by an independent inspector, acceptable to the Architect, prequalified to make the weld being inspected. Welders and inspectors shall be prequalified by the American Welding Society Qualification Test.

C. The Construction Manager performing the welding requiring inspection shall coordinate with an independent testing service, acceptable to the Architect to perform weld testing.

D. Submit written reports for each weld tested. Provide project identification and number, date of report, name of Welding Subcontractor, name of testing service, location of weld, type of weld, and test results. Indicate whether or not weld is acceptable for intended use.

E. If by inspection welds fail to meet minimum acceptable criteria, the welds shall be cut out and replaced.

F. Welders shall make only those types of welds for which they are specifically certified.

1.18 BOLTED STRUCTURAL CONNECTIONS QUALITY CONTROL

A. The Construction Manager for the work of specification section “Structural Metal Framing”, shall coordinate with a separate testing laboratory, to perform field quality control inspection of slip-

critical and snug-tight bolted connections and shall follow testing required in the applicable section and if none is indicated provide the following;

B. Inspection of slip-critical connections shall be visual. The inspector shall be present at the beginning of steel erection to insure that the erector is conforming to the Contract Documents and AISC Specifications. The inspector shall verify that the erector is marking the bolts and nuts prior to the turn-of-nut procedure. Ten percent of all slip-critical bolted connections shall be observed as they are installed. Any connections which, in the opinion of the inspector, do not meet the tightening requirements of the Contract Documents shall be corrected by the erector.
   1. Inspection of snug-tight connections shall be made by use of a spud wrench. Ten percent of all snug-tight bolted connections selected randomly over the entire limits of the building structure shall be tested to verify tightness. If more than 20 percent of the bolts tested do not meet the General Requirements of the Contract Documents, the erector shall be required to retighten all snug-tight bolted connections on the Project.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 REPAIR AND PROTECTION

A. General: Upon completion of inspection, testing, sample-taking, and similar services performed on Work, repair damaged Work and restore substrates and finishes to eliminate deficiencies including defects in visual qualities of exposed finishes. Except as otherwise indicated, comply with requirements of Contract Documents. Protect Work exposed by or for service activities and protect repaired Work. Repair and protection are Construction Manager's responsibility, regardless of assignment of responsibility for inspection, testing, or similar service.

END OF SECTION

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SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications and the Sections included under Division 01, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. This Section includes requirements for construction facilities and temporary controls, including temporary utilities, support facilities, and security and protection.

B. Temporary utilities include, but are not limited to, the following:
   1. Water service and distribution.
   2. Temporary electric power and light.
   3. Temporary heat.
   4. Ventilation.
   5. Sanitary facilities, including drinking water.
   6. Storm and sanitary sewer.

C. Support facilities include, but are not limited to, the following:
   1. Field offices and storage sheds.
   2. Temporary roads and paving.
   3. Dewatering facilities and drains.
   4. Temporary enclosures.
   5. Temporary project identification signs and bulletin boards.
   6. Waste disposal services.
   7. Rodent and pest control.
   8. Construction aids and miscellaneous services and facilities.

D. Security and protection facilities include, but are not limited to, the following:
   1. Temporary fire protection.
   2. Barricades, warning signs, and lights.
   3. Sidewalk bridge or enclosure fence for the site.
   4. Environmental protection.

1.3 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2027.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Temporary Utilities: Submit reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities.
   1. Implementation and Termination Schedule: Within 15 days of the date established for commencement of the Work, submit a schedule indicating implementation and termination of each temporary utility.

1.6 QUALITY ASSURANCE

A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction including, but not limited to, the following:
   1. Building code requirements.
   2. Health and safety regulations.

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3. Utility company regulations.
4. Police, fire department, and rescue squad rules.
5. Environmental protection regulations.

B. Standards: Comply with NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations," ANSI A10 Series standards for "Safety Requirements for Construction and Demolition," and NECA Electrical Design Library "Temporary Electrical Facilities."
1. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70 "National Electric Code."

C. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.7 PROJECT CONDITIONS

A. Temporary Utilities: Prepare a schedule indicating dates for implementation and termination of each temporary utility. At the earliest feasible time, when acceptable to the Owner, change over from use of temporary service to use of permanent service.
1. Verify with Owner how Use Charges will be paid.

B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the Work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist on-site.

C. Verify with Owner if Educational Facilities Inspector’s (EFI) Trailer is required for Project. Provide location and access in accordance with Owner’s requirements.

PART 2 PRODUCTS

2.1 MATERIALS

A. General: Provide new materials. If acceptable to the Architect/Owner, the Contractor may use undamaged, previously used materials in serviceable condition. Provide materials suitable for use intended. These materials shall not create unsafe conditions, and shall not violate requirements of applicable codes and standards.

B. Lumber and Plywood: Comply with requirements in Division 06 Section "Rough Carpentry."
1. For job-built temporary offices, shops, and sheds within the construction area, provide UL-labeled, fire-treated lumber and plywood for framing, sheathing, and siding.
2. For signs and directory boards, provide exterior-type, Grade B-B high-density concrete form overlay plywood of sizes and thicknesses indicated.
3. For safety barriers, sidewalk bridges, and similar uses, provide minimum 5/8-inch- (16-mm-) thick exterior plywood.

C. Gypsum Wallboard: Provide gypsum wallboard on interior walls of temporary offices.

D. Roofing Materials: Provide UL Class A standard-weight asphalt shingles or UL Class C mineral-surfaced roll roofing on roofs of job-built temporary offices, shops, and sheds.

E. Paint: Comply with requirements of Sections 09 91 13 - "Exterior Painting" and 09 91 23 - "Interior Painting."
1. For job-built temporary offices, shops, sheds, fences, and other exposed lumber and plywood, provide exterior-grade acrylic-latex emulsion over exterior primer.
2. For sign panels and applying graphics, provide exterior-grade alkyd gloss enamel over exterior primer.
3. For interior walls of temporary offices, provide 2 coats interior latex-flat wall paint.

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F. Tarpaulins: Provide waterproof, fire-resistant, UL-labeled tarpaulins with flame-spread rating of 15 or less. For temporary enclosures, provide translucent, nylon-reinforced, laminated polyethylene or polyvinyl chloride, fire-retardant tarpaulins.

G. Water: Provide potable water approved by local health authorities.

H. Open-Mesh Fencing: Provide 0.120-inch (3-mm-) thick, galvanized 2-inch (50-mm) chainlink fabric fencing 6 feet (2 m) high with galvanized barbed-wire top strand and galvanized steel pipe posts, 1 1/2 inches (38 mm) I.D. for line posts and 2 1/2 inches (64 mm) I.D. for corner posts.

I. All temporary facilities of any type shall comply with all O.S.H.A. requirements. The Contractor is solely responsible for compliance.

2.2 EQUIPMENT

A. General: Provide new equipment. If acceptable to the Architect, the Contractor may use undamaged, previously used equipment in serviceable condition. Provide equipment suitable for use intended.

B. Water Hoses: Provide 3/4-inch (19-mm), heavy-duty, abrasion-resistant, flexible rubber hoses 100 feet (30 m) long, with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shutoff nozzles at hose discharge.

C. Electrical Outlets: Provide properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-Volt plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button, and pilot light for connection of power tools and equipment.

D. Electrical Power Cords: Provide grounded extension cords. Use hard-service cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.

1. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered-glass enclosures where exposed to breakage. Provide exterior fixtures where exposed to moisture.

E. Heating Units: Provide temporary heating units that have been tested and labeled by UL, FM, or another recognized trade association related to the type of fuel being consumed.

F. Temporary Offices: Provide prefabricated or mobile units or similar job-built construction with lockable entrances, operable windows, and serviceable finishes. Provide heated and air-conditioned units on foundations adequate for normal loading.

G. Provide an additional office trailer for exclusive use by the Owner.

H. Temporary Toilet Units: Provide self-contained, single-occupant toilet units of the chemical, aerated recirculation, or combustion type. Provide units properly vented and fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.

I. Fire Extinguishers: Provide hand-carried, portable, UL-rated, Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide hand-carried, portable, UL-rated, Class ABC, dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for the exposures.

1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

PART 3 EXECUTION

3.1 INSTALLATION

A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.

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B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Engage the appropriate local utility company to install temporary service or connect to existing service. Where company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with company recommendations.
   1. Arrange with company and existing users for a time when service can be interrupted, if necessary, to make connections for temporary services.
   2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.
   3. Obtain easements to bring temporary utilities to the site where the Owner's easements cannot be used for that purpose.
   4. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Architect. Neither the Owner nor Architect will accept cost or use charges as a basis of claims for Change Orders.

B. Water Service: Install water service and distribution piping of sizes and pressures adequate for construction until permanent water service is in use.
   1. Sterilization: Sterilize temporary water piping prior to use.

C. Temporary Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnects, automatic ground-fault interrupters, and main distribution switch gear.
   1. Install electric power service underground, except where overhead service must be used.
   2. Power Distribution System: Install wiring overhead and rise vertically where least exposed to damage. Where permitted, wiring circuits not exceeding 125 Volts, ac 20 Ampere rating, and lighting circuits may be nonmetallic sheathed cable where overhead and exposed for surveillance.

D. Temporary Lighting: When overhead floor or roof deck has been installed, provide temporary lighting with local switching.
   1. Install and operate temporary lighting that will fulfill security and protection requirements without operating the entire system. Provide temporary lighting that will provide adequate illumination for construction operations and traffic conditions.

E. Temporary Heat: Provide temporary heat required by construction activities for curing or drying of completed installations or for protection of installed construction from adverse effects of low temperatures or high humidity. Select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy. Provide adequate forced ventilation of enclosed areas to prevent hazardous accumulations of dust, pumes, vapors, or gases.

F. Heating Facilities: Except where the Owner authorizes use of the permanent system, provide vented, self-contained, LP-gas or fuel-oil heaters with individual space thermostatic control.
   1. Use of gasoline-burning space heaters, open flame, or salamander heating units is prohibited.

G. Sanitary facilities include temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for the type, number, location, operation, and maintenance of fixtures and facilities. Install where facilities will best serve the Project's needs.
   1. Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Provide covered waste containers for used material.
   2. Service, clean and maintenance facilities and enclosures.

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H. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy. Use of pit-type privies will not be permitted.
   1. Provide separate facilities for male and female personnel.

I. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel involved in handling materials that require wash-up for a healthy and sanitary condition. Dispose of drainage properly. Supply cleaning compounds appropriate for each condition:
   1. Sanitation of personnel.

J. Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds, and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off-site in a lawful manner.
   1. Filter out excessive amounts of soil, construction debris, chemicals, oils, and similar contaminants that might clog sewers or pollute waterways before discharge.
   2. Connect temporary sewers to the municipal system, as directed by sewer department officials.
   3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. Following heavy use, restore normal conditions promptly.

K. Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of storm water from heavy rains.

L. Do not allow use of permanent facilities by construction personnel.

3.3 SUPPORT FACILITIES INSTALLATION

A. Locate field offices, storage sheds, and other temporary construction and support facilities for easy access.
   1. Maintain support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.

B. Provide incombustible construction for offices, shops, and sheds located within the construction area or within 30 feet of building lines. Comply with requirements of NFPA 241.

C. Field Offices: Provide insulated, weathertight temporary offices, minimum size of 10’ x 14’, of sufficient size to accommodate required office personnel, Owners/Architects/Engineers at the Project Site. Provide a separate trailer for the Owner’s exclusive use. Keep the office clean and orderly for use for small progress meetings. Furnish and equip offices as follows:
   1. Furnish with (2) desks and (4) chairs, a 4-drawer lockable file cabinet, plan table, plan rack, a 6-shelf bookcase, four (4) duplex outlet, separate telephone lines with two (2) hand sets and adequate lighting.
   2. Equip with a water cooler and private toilet complete with water closet, lavatory, and medicine cabinet unit with a mirror.
   3. Maintain temporary structures, offices, and storage in a safe and sanitary condition at all times during construction. Do not violate any local codes or ordinances regarding these facilities.

D. Storage and Fabrication Sheds:
   1. General Requirements:
      a. Install storage and fabrication sheds sized, furnished, and equipped to accommodate materials and equipment involved, including temporary utility service. Sheds may be open shelters or fully enclosed spaces within the building or elsewhere on-site.
      b. Store products immediately upon delivery in accord with manufacturers written directions.
      c. Arrange for storage location to allow access, maintenance and inspection of products.

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d. Stored products shall not conflict with work conditions. construction is contiguous to or within existing school, Provide demising walls to physically separate new or renovation work from existing on-going school operations.

2. Enclosed Storage:
   a. Store products subject to damage by weather in weathertight enclosure.
   b. Maintain temperature and humidity within ranges stated in manufacturer's instructions.
   c. Provide temperature and humidity control within ranges stated in manufacturer's instructions.
   d. Store unpacked or loose products on shelves, in bins, or in neat groups of like items.
3. Exterior Storage:
   a. Provide platforms, blocking or skids to support fabricated products above ground, and sloped to allow drainage.
   b. Protect products to avoid soiling or staining.
   c. Provide product cover to prevent water or condensation on product while allowing ventilation.
   d. Store loose granular materials on clean, solid surfaces such as pavement or on rigid sheet materials to prevent mixing with foreign matter.
   e. Provide for surface drainage to prevent humidity, mold or algae growth.
4. Maintenance of Storage:
   a. Periodically inspect stored products on scheduled basis.
   b. Verify storage facilities and environmental conditions are in compliance with manufacturer's written requirements.
   c. Verify that product surfaces exposed to weather are undamaged, stolen, or have otherwise been adversely affected.
5. Maintenance of Equipment Storage:
   a. Stored mechanical and electrical equipment shall comply with manufacturer's written service instructions for each item, with notice of instructions attached to each item of equipment.
   b. Stored equipment shall be serviced on regular basis. Maintain log of services, and submit to Architect as part of Project Record Documents.
6. Storage of Owner's Salvaged Furnishings and Equipment:
   a. Contractor/CM shall provide temporary storage facilities for items to be salvaged and reinstalled.

E. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities.
   1. Where heat is needed and the permanent building enclosure is not complete, provide temporary enclosures where there is no other provision for containment of heat. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
   2. Install tarpaulins securely, with incombustible wood framing and other materials. Close openings of 25 sq. ft. or less with plywood or similar materials.
   3. Close openings through floor or roof decks and horizontal surfaces with load-bearing, wood-framed construction.
   4. Where temporary wood or plywood enclosure exceeds 100 sq. ft. in area, use UL-labeled, fire-retardant-treated material for framing and main sheathing.

F. Project Identification and Temporary Signs: Prepare project identification and other signs of size indicated. Install signs where indicated to inform the public and persons seeking entrance to the Project. Support on posts or framing of preservative-treated wood or steel. Do not permit installation of unauthorized signs.
   1. Project Identification Signs: Engage an experienced sign painter to apply graphics. Comply with details indicated.

2. Temporary Signs: Prepare signs to provide directional information to construction personnel and visitors.
   a. Sizes, color & lettering of signs are to be as required by regulatory as approved by Architect.
   b. Erect at appropriate locations to provide required information.
3. Sign Materials:
   a. Structure and Framing: May be new or used, wood or metal, in sound condition, structurally adequate to work, suitable for specified finish and visibly attractive.
   b. Sign Surfaces: Exterior grade softwood plywood for exterior signs and standard grade plywood for interior signs, with medium density overlay, standard large sizes to minimize joints.
      1) Thickness: As required by standards to span framing members, to provide even, smooth surface without waves or buckles, consideration given to painted surfaces and length of exposure during project time period.
4. Rough Hardware: Galvanized. Paint hardware on interior signs.
   a. Paint: Exterior quality, as specified in Section 09 91 13, for exterior sign. Interior quality for interior signs.
      1) Colors for Structure, Framing, Sign Surfaces and Graphics: As selected by Architect.
5. Painted surfaces to be primed prior to final painting.
   a. Use paint as manufactured by Pratt & Lambert, or Architect approved equal per the following for exterior signage.
   b. One (1) coat P & L Permalize Exterior Primer (front and back).
   c. Two (2) coats P & L Aqua Royal House and Trim Finish.
      1) For interior signage, use paint as approved in Section 09 91 23, priming both front and back sides.
         (a) Letter Style: Shall be Helvetica Regular, or as otherwise requested by the Owner to meet the facility standards.

G. Temporary Exterior Lighting: Install exterior yard and sign lights so signs are visible when Work is being performed.

H. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than 7 days during normal weather or 3 days when the temperature is expected to rise above 80 deg F (27 deg C). Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material lawfully.

I. Rodent and Pest Control: Before deep foundation work has been completed, retain a local exterminator or pest control company to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests. Employ this service to perform extermination and control procedures at regular intervals so the Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Except for use of permanent fire protection as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer, as requested by the Architect.

B. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguishers" and NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations."

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1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher on each floor.
2. Store combustible materials in containers in fire-safe locations.
3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for fighting fires. Prohibit smoking in hazardous fire-exposure areas.
4. Provide supervision of welding operations, combustion-type temporary heating units, and similar sources of fire ignition.

C. Permanent Fire Protection: At the earliest feasible date in each area of the Project, complete installation of the permanent fire-protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.

D. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed, provide lighting, including flashing red or amber lights.

E. Enclosure Fence: Before excavation begins, install an enclosure fence with lockable entrance gates. Locate where indicated, or enclose the entire site or the portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs, and other animals from easily entering the site, except by the entrance gates.
1. Provide open-mesh, chainlink fencing with posts set in a compacted mixture of gravel and earth.
2. Locate vehicular entrance gates in suitable relation to construction facilities; and to avoid interference with traffic on public thorough fares.
3. Locate pedestrian entrance gates as required to provide controlled personnel entry in suitable relation to construction parking facilities.
4. Security Enclosure and Lockup: Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.
    a. Theft Prevention: Provide a secure lockup. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism.

F. Security Enclosure and Lockup: Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.
1. Storage: Where materials and equipment must be stored, and are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism.

G. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways, and subsoil might be contaminated or polluted or that other undesirable effects might result. Avoid use of tools and equipment that produce harmful noise. Restrict use of noise-making tools and equipment to hours that will minimize complaints from persons or firms near the site.

3.5 ACCESS ROADS AND PARKING AREAS

A. Site Access Roads:
1. Provide site access for construction equipment and vehicles from public thoroughfares.
2. Inform all construction personnel of location of Project, means for access to site and parking areas. Coordinate with Owner.

B. On-Site Roads and Parking Areas:

1. Locate road, drives, walks and parking facilities to provide uninterrupted access to construction offices, mobilization, work, storage areas, and other areas required for execution of the Contract.
2. Provide access for emergency vehicles.
3. Maintain driveways a minimum of 15 feet wide between and around combustible materials in storage and mobilization areas.
4. Maintain traffic areas free as possible of excavated materials, construction equipment, products and debris.
5. Keep fire hydrants and water control valves free from obstruction and accessible for use.

3.6 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.

B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.
   1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
   2. Protection: Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

C. Termination and Removal: Unless the Architect requests that it be maintained longer, remove each temporary facility when the need has ended, when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
   1. Materials and facilities that constitute temporary facilities are the Contractor's property. The Owner reserves the right to take possession of project identification signs.

END OF SECTION

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SECTION 01 56 00 - TEMPORARY BARRIERS AND ENCLOSURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Temporary jobsite protection including the following:
   1. Temporary floor and wall protection.
   2. Door jamb protection.
   3. Small project floor and wall protection.
   4. Seaming tape for floor protection.
   5. Recyclable, portable jobsite trash containers.

1.3 REFERENCES

A. Forest Stewardship Council (FSC).

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 ACTION SUBMITTALS

A. Refer to Section 01 30 00.0 – Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 – Product Requirements for submittal procedures.

C. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

1.6 QUALITY ASSURANCE

A. Manufacturer: Minimum Five (5) years’ experience manufacturing similar products.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.

B. Handle materials to avoid damage.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer and basis of design shall be the following. However, products of other manufacturers will be considered for acceptance, provided they equal or exceed the material requirements and functional qualities of the specified product, and acceptance is provided by the Architect in writing prior to bidding.
   1. Ram Board.

B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
   1. Surface Shields.
   2. Trimaco, Inc.

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2.2 TEMPORARY FLOOR AND WALL PROTECTION

A. Temporary protection board shall comply with the following requirements, as necessary for the use.
   1. Materials:
      a. FSC certified.
   2. Fold lines allowing corner, horizontal and vertical wall protection.
      a. Wall guard fold lines at 4 inches (101 mm), 8 inches (203 mm) and 12 inches (305 mm) from edge of board.
   3. Allow protected substrates and finishes to cure while being protected.
   4. Protection against water, paint, mud, and more.

B. Protection Boards:
   1. Basis of Design Products as manufactured by Ram Board.
      a. Heavy Duty Temporary and Reusable Floor and Wall Protection: Model #RB 38-100.
      b. Pre-Taped Board: Ram Board Plus Model #RB PLUS 38-100.
      c. Reusable Protection for Small Projects: Home Edition Model #RBHE 36-50.
      d. Painter's Board: Ram Board Painter's Board Model #20RB 35-50.

2.3 DOOR JAMB PROTECTION

A. Door Jamb Protection: Heavy-duty flexible re-usable door jamb protection.
   1. Materials: Recycled and recyclable materials.
   2. Door Jamb Sizes: Fits 4 inches – 9 inches (102 mm – 229 mm).
   3. Basis of Design Product: Model # RBJP 60, or RBJP 36 Ram Jamb, as manufactured by Ram Board.

2.4 SEAMING AND EDGE TAPES FOR FLOOR PROTECTION

A. Seaming Tape: Used to cover Ram Board seams.
   1. Backing: Unique kraft backing tears easily and creates an extremely durable, smooth finish.
   2. Basis of Design Product: Model #RT 3-164, as manufactured by Ram Board.

B. Vapor-Cure Tape: Used to cover Ram Board seams which prevents tape lines.
   1. Performance: Allows vapors and moisture to escape from concrete, glue down floors, stained floors, epoxy floors, refinished floors, vinyl composition tile, and most other floor types.
   2. Basis of Design Product: Model #RB VCT 3-108, as manufactured by Ram Board.

C. Edge Tape: Used to secure Temporary Floor Protection edges to flooring or wall surfaces.
   1. Performance: Easy Release, low tack tape for up to 14 days. Grips tightly to Ram Board while easy release on flooring surfaces up to 14 days.
   2. Basis of Design Product: Model #RB ET 2.5-180, as manufactured by Ram Board.

2.5 PORTABLE JOBSITE TRASH CONTAINERS

A. Portable Jobsite Trash Containers: Portable, reusable jobsite trash container.
   1. Fits Trash Bags: 42 gal – 50 gal (159 to 189 L).
   2. Quick self-locking assembly, no tape required.
   3. Basis of Design Product: Trash Box Model # RBTB 16-36, as manufactured by Ram Board.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation. Proceed with installation or protection products only after unsatisfactory conditions have been corrected.

B. Do not begin protection installation until substrates have been properly prepared.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 INSTALLATION

A. Install protection products in accordance with manufacture's written instructions and approved submittals.

3.3 PROTECTION

A. Protection installed products may be left in place until completion of project or adjacent work.

END OF SECTION

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SECTION 01 56 39 - TEMPORARY TREE AND PLANT PROTECTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Protection of existing trees (Refer also to the Drawings).

B. Protection of existing utilities.

C. Protection of fencing and planking

1.3 REFERENCE STANDARDS

A. ANSI A300 Part 1 - American National Standard for Tree Care Operations - Tree, Shrub, and Other Woody Plant Management - Standard Practices (Pruning); 2017.

B. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2024a.

1.4 REFRENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 GENERAL PROVISIONS

A. Trees and areas scheduled for work under this contract shall be identified in the field and indicated on plans and specifications where practical. Where this is not practical, work shall be directed in field by the ...

B. Provision for access to the site for heavy equipment will be as directed by Owner’s Representative. Equipment shall use prescribed temporary roadways and shall not be allowed in areas other than designated construction areas and designated roadways. Open grass areas which are altered or disturbed by equipment during the work shall be returned to pre-existing conditions at no additional cost to the Owner.

C. The Construction Manager shall protect root areas and crowns of trees from damage from construction operations and construction equipment. The Construction Manager shall repair such damage at no costs to the Owner. Provide fences or other barricades where necessary for such protection.

D. The Construction Manager shall modify exhaust pipes on construction equipment as needed to ensure that tree crowns are not damaged from exhaust heat from vertical exhaust pipes on construction equipment.

E. Equipment shall not contact tree trunks, limbs or foliage.

F. The Construction Manager shall be responsible for providing all tree work/repair to any damage to existing trees during the contract period. Damage to any existing trees shall be reported immediately to the Owner’s Representative. The Construction Manager shall submit to the Owner’s Representative a written program of corrective pruning and tree care to repair damage with name of qualified forester or arborculturist for the Owner’s approval.

1.6 SUBMITTALS

A. Refer to Section 01 30 00 – Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00 – Product Requirements for substitution procedures.

C. Furnish required copies of manufacturer's literature, samples, certifications, or laboratory Analytical data for the following items:
   1. Tree paint (manufacturer’s literature).

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D. Urban forester or Arborist. (Resume with education, experience, and credentials)

E. Soil separator (manufacturer's literature and sample). For vapor barrier 10 mil visquene.

F. Gravel (1 cubic foot).

G. Mulch: Decomposed hardwood mulch: submit 1 cubic foot sample.

H. Fertilizer: Submit product data.

PART 2 PRODUCTS

2.1 TRENCHING MACHINE

A. Shall be small, non-riding track type trencher equal to Case 300.

2.2 SHARP SAND

A. ASTM C33/C33M for fine aggregate.

2.3 TREE PROTECTION FENCE POSTS

A. 7-foot-long metal T-Posts.

2.4 TREE PAINT

A. Thompson Tree Seal, Cabot Tree Paint or approved equal.

2.5 PRUNING TOOLS

A. Shall be of good quality and working condition, sharp and approved type for arboricultural work.

2.6 WOOD FOR TREE PROTECTION PLANKING

A. Shall be construction grade Southern Yellow Pine.

B. Wood for Planking: 2x4.

2.7 FENCING

A. Shall be orange plastic fencing 4 feet tall.

2.8 INSECTICIDE

A. Manufacturers.
   1. Arborjet, Inc.: www.arborjet.com.
   2. Ortho, A brand of The Scotts Company, LLC: www.ortho.com.
   3. Substitutions: Refer to Section 01 60 00.0 - Product Requirements for substitution procedures.

B. Basis of Design Products:
   1. "IMA-jet Systemic Insecticide" manufactured by Arborjet, Inc.
   2. "Lindane Borer and Leaf Miner Spray" manufactured by Ortho.

PART 3 EXECUTION

3.1 WORKMANSHIP

A. Work shall be performed by personnel trained and experienced in this work and shall be done under the direction of a qualified forester or arborist on the Construction Manager's staff. The Owner shall review and approve the Construction Manager's program for repair to damaged trees prior to the work being done.

B. Work shall be performed in conformance with recognized horticultural and arboricultural practices. Where job requirements require deviation from normal practice, obtain approval.

3.2 LIMB PRUNING

A. Comply with ANSI A300 Part 1.

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3.3 MAINTENANCE PRUNING

A. Maintenance pruning is to maintain or improve tree health and structure and shall consist of the following: limited to branches measuring 1 inch and larger.

B. Crown Cleaning: Crown cleaning shall consist of the removal of the following items: dead, dying, diseased, weak branches from a tree's crown. Remove waterspouts from trucks and major limbs clearing up to a maximum distance of only 6 feet to 8 feet from main trunk.

C. Crown Thinning: Crown thinning shall consist of the selective removal of branches to increase light penetration, air movement, and reduce weight.

D. Crown Raising: Crown raising shall consist of the removal of the lower branches of a tree in order to provide clearance. Clearance to be determined by the ..

E. All trees designated to remain and to be protected shall be pruned per ANSI A300 Part 1 1995 standards.

F. All cuts shall be made as close as possible to the trunk or parent limb, without cutting into the branch collar or leaving a protruding stub. Bark at the edge of all pruning cuts should remain firmly attached.

G. All branches too large to support with one hand shall be precut to avoid splitting or tearing of the bark. Where necessary, ropes or other equipment should be used to lower large branches or stubs into the ground.

H. Trimming shall not alter the natural appearance or result in leaving a hole in the canopy.
   1. Paint wounds on Oak trees with approved paint.
   2. Old injuries are to be inspected. Those not closing properly and where the callus growth is not already completely established should be bark traced if the bark appears loose or damaged. Such tracing shall not penetrate xylem (sapwood), and margins shall be kept rounded.
   3. Equipment that will damage the bark and cambium layer should not be used on or in the tree. For example, the use of climbing spurs (hooks, irons) is not an acceptable work practice for pruning operations on live trees. Sharp tools shall be used so that clean cuts will be made at all times.
   4. All cut limbs shall be removed from the crown upon completion of the pruning.
   5. Trees susceptible to serious infectious diseases should not be pruned at the time of year during which the pathogens causing the diseases, or the insect vectors are most active. Similarly, if pruning wounds may attract harmful insects, pruning should be timed so as to avoid insect infestation.
   6. Remove the weaker or less desirable of crossed or rubbing branches. Such removal, if possible, should not leave large open spaces in the general outline of the tree.
   7. Where practical, all visible girdling roots shall be treated by the following methods:
      a. Cut root at either end.
      b. Sever root in center with a chisel and allow growing tree to push root away.
      c. Remove section of root.
   8. The presence of any disease condition, fungus fruit bodies, decayed trunk or branches, split crotches or branches, cracks, or other structural weaknesses shall be reported in writing to a supervisor and/or the Owner and corrective measures recommended.

3.4 ROOT PRUNING (IN AREAS WHERE ROOTS CANNOT BE PRESERVED BY HAND DIGGING)

A. Root pruning shall be installed at the back of new curb for the parking lot excavation where the excavation for the lot lowers the grade below the existing grade within the drip line of the existing trees and in areas where soils will be lime stabilized.

B. Root prune at edge of proposed excavation or lime stabilization only in areas where roots cannot be preserved.

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C. Root pruning by trenching shall be as required; 24 inches deep and 6 inches wide, or 10 inches below limits of proposed excavation, lime stabilization or soil disturbance, whichever is less.

D. Trenching shall be performed by the approved trencher cutting any and all roots completely and cleanly. Tearing, shredding or pulling of the roots shall not be permitted. After trenching with machine, re-cut roots with pruning shears or saw to leave a smooth cut surface.

E. Install 10 mil visqueen in root prune trench to create non-leach barrier between soil stabilizer material and root zone.

F. Fill trench to existing finished grade in a manner that will not allow soils to settle.

G. Cover exposed roots within 24 hours using bank sand topsoil or mulch to prevent desiccation.

3.5 FENCES AND BARRICADES

A. Fences and/or barricades shall be installed prior to the commencement of any site preparation work (cleaning, grubbing or grading) placed where shown on the drawings or as herein described. Tree fencing shall be maintained throughout the construction project in order to prevent the following:
   1. Soil compaction in the root zone area resulting from vehicular traffic or storage of equipment and/or equipment and/or materials.
   2. Root zone disturbances due to grade changes (greater than 3 inches cut or fill), and /or trenching not reviewed or authorized by the ..
   3. Wounds to exposed roots, trunks, or limbs by mechanical equipment.
   4. Other activities detrimental to tress such as: chemical storage, cement truck wash-out and fires.

B. In general, fences and barricades are intended to alert those working on the project that equipment and machinery are not to be stored or operated in the root zone. Where not shown, the fences shall be placed at the drip line. The exact location of fences shall be marked on site by the Construction Manager and approved by the . prior to construction of barricades.

C. Posts shall be installed 8 feet O.C. maximum, 1-1/2 feet deep. Fence material pulled taut and secured with galvanized wire.

3.6 TREE PLANKING

A. Where exceptions result in temporary fence being closer than four feet to a tree trunk, protect trunk with strapped-on wood planking to a vertical height of 8 feet (or to the limits of the lower branches).

B. Place two by fours with sides touching completely around the circumference of the tree. Secure at three points; top, middle and bottom with galvanized wire; twisted taut and stapled to wood planking.

3.7 TREE PROTECTION

A. All trees to be preserved on the property shall be protected against damage during construction operations by fencing as shown; subject to the approval of the... The tree protection shall be installed prior to commencement of any site preparation work (clearing, grubbing or grading) and maintained in repair for the duration of the construction work unless otherwise directed. No material shall be stored nor construction operation carried on within a distance as shown of any tree to be saved or within the tree protection fencing. Tree protection shall remain until all work is completed.
   1. Place 6 inches of mulch to completely cover the area underneath the drip line of the trees in areas where foot traffic cannot be avoided.
   2. Trees shall be watered once a week during periods of hot dry weather or as directed by the representative to thoroughly saturate soil.
   3. All grading within protected root zone areas shall be by hand or small equipment to prevent root damage resulting from soil compaction and rutting. Prior to grading relocate protective fencing to two feet behind grade change area.

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B. Any damage done to existing tree crowns or root systems shall be repaired immediately by an approved tree surgeon at the Owner's direction. Roots exposed and/or damaged during demolition and/or grading operations shall be cut off cleanly inside the exposed or damaged area, the cut surfaces painted with an approved tree paint, and the topsoil and mulch placed over the exposed root area immediately. The Owner shall have their representative present on the site to observe these operations.

3.8 CONSTRUCTION EQUIPMENT

A. The Construction Manager shall modify construction equipment as necessary to ensure that exhaust systems do not burn or scorch tree crowns or branches. Vertical exhaust pipes shall be turned 90 degrees.

B. Height of equipment and equipment operation heights shall be carefully monitored to ensure no damage to tree crowns or branching.

3.9 BORER PROTECTION

A. Immediately after tree protection is complete, apply specified insecticide at the rate prescribed by the manufacturer's instructions.

3.10 APPLICATION OF TREE FERTILIZER

A. Arbor Green 30-10-7 mixed and applied per product label instruction for 40 pounds of Arbor Green mixed in 100 gallons of water. Fertilizer shall be added to tank and mixed on site. The . shall be notified 24 hours prior to applying fertilizer.

3.11 ADDITIONAL PROVISIONS

A. No trash or warming fires shall be placed within 25 feet of the tree canopy.

B. No pedestrian traffic shall occur within the drip line of any tree without proper protection measures in place.

C. No soil shall be spread under any tree within the drip line, unless otherwise designated or approved by the...

D. Hand dig to preserve roots measuring 1 inch in diameter and larger, roots shall not be scuffed or damaged otherwise.

END OF SECTION

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SECTION 01 57 19 - TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Construction procedures to promote adequate indoor air quality after construction.

B. Building flush-out after construction and before occupancy.

C. Testing indoor air quality before commencement of construction; existing building areas only.

D. Testing indoor air quality after completion of construction.

E. Testing air change effectiveness after completion of construction.

1.2 PROJECT GOALS

A. Dust and Airborne Particulates: Prevent deposition of dust and other particulates in HVAC ducts and equipment.
   1. Cleaning of ductwork is not contemplated under this Contract.
   2. Construction Manager shall bear the cost of cleaning required due to failure to protect ducts and equipment from construction dust.
   3. Establish condition of existing ducts and equipment prior to start of alterations.

B. Airborne Contaminants: Procedures and products have been specified to minimize indoor air pollutants.
   1. Furnish products meeting the specifications.
   2. Avoid construction practices that could result in contamination of installed products leading to indoor air pollution.

1.3 REFERENCE STANDARDS

A. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2025.

B. ASHRAE Std 129 - Measuring Air-Change Effectiveness; 1997 (Reaffirmed 2002).

C. ASTM D5149 - Standard Test Method for Ozone in the Atmosphere: Continuous Measurement by Ethylene Chemiluminescence; 2024.

D. ASTM D5197 - Standard Test Method for Determination of Formaldehyde and Other Carbonyl Compounds in Air (Active Sampler Methodology); 2021.

E. ASTM E1186 - Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems; 2022.

F. ASTM E1827 - Standard Test Methods for Determining Airtightness of Buildings Using an Orifice Blower Door; 2022.

G. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.2; 2017.

H. EPA 600/4-90/010 - Compendium of Methods for the Determination of Air Pollutants in Indoor Air; 1990.

I. EPA 625/R-96/010b - Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air; 1999, with Addendum (2000).

J. SMACNA (OCC) - IAQ Guidelines for Occupied Buildings Under Construction; 2007.

1.4 DEFINITIONS

A. Refer to Section 01 42 16 – Definitions, for the following terms:
   1. Adsorptive Materials.
   2. Contaminants.
   3. Particulates.

4. Wet Work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 – Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 – Product Requirements for substitution procedures.

C. Indoor Air Quality Management Plan: Describe, in detail, measures to be taken to promote adequate indoor air quality upon completion; use SMACNA (OCC) as a guide.
   1. Submit not less than 60 days before enclosure of building.
   2. Identify potential sources of odor and dust.
   3. Identify construction activities likely to produce odor or dust.
   4. Identify areas of project potentially affected, especially occupied areas.
   5. Evaluate potential problems by severity and describe methods of control.
   6. Describe construction ventilation to be provided, including type and duration of ventilation, use of permanent HVAC systems, types of filters and schedule for replacement of filters.
   7. Describe cleaning and dust control procedures.
   8. Describe coordination with commissioning procedures.
   9. Describe measures specific for Healthcare projects, including, as applicable, plan for issues related to moisture, particulates, VOCs, outdoor emissions, tobacco, noise and vibration, and infection control.

D. Interior Finishes Installation Schedule: Identify each interior finish that either generates odors, moisture, or vapors or is susceptible to adsorption of odors and vapors, and indicate air handling zone, sequence of application, and curing times.

E. Duct and Terminal Unit Inspection Report.

F. Air Contaminant Test Plan: Identify:
   1. Testing agency qualifications.
   2. Locations and scheduling of air sampling.
   3. Test procedures, in detail.
   4. Test instruments and apparatus.
   5. Sampling methods.

G. Air Contaminant Test Reports: Show:
   1. Location where each sample was taken, and time.
   2. Test values for each air sample; average the values of each set of 3.
   3. HVAC operating conditions.
   4. Certification of test equipment calibration.
   5. Other conditions or discrepancies that might have influenced results.

H. Ventilation Effectiveness Test Plan: Identify:
   1. Testing agency qualifications.
   2. Description of test spaces, including locations of air sampling.
   3. Test procedures, in detail; state whether tracer gas decay or step-up will be used.
   4. Test instruments and apparatus; identify tracer gas to be used.
   5. Sampling methods.

I. Ventilation Effectiveness Test Reports: Show:
   1. Preliminary tests of instruments and apparatus and of test spaces.
   2. Calculations of ventilation effectiveness, variable "E".
   3. Location where each sample was taken, and time.
   4. Test values for each air sample.
   5. HVAC operating conditions.
   6. Other information specified in ASHRAE Std 129.
   7. Other conditions or discrepancies that might have influenced results.

1.6 QUALITY ASSURANCE

A. Testing and Inspection Agency Qualifications: Independent testing agency having minimum of 5 years experience in performing the types of testing specified.

PART 2 PRODUCTS

2.1 MATERIALS

A. Low VOC Materials: See other sections for specific requirements for materials with low VOC content.

B. Auxiliary Air Filters: MERV of 8, minimum, when tested in accordance with ASHRAE Std 52.2.

PART 3 EXECUTION

3.1 CONSTRUCTION PROCEDURES

A. Prevent the absorption of moisture and humidity by adsorptive materials by:
   1. Sequencing the delivery of such materials so that they are not present in the building until wet work is completed and dry.
   2. Delivery and storage of such materials in fully sealed moisture-impermeable packaging.
   3. Provide sufficient ventilation for drying within reasonable time frame.

B. Begin construction ventilation when building is substantially enclosed.

C. If extremely dusty or dirty work must be conducted inside the building, shut down HVAC systems for the duration; remove dust and dirt completely before restarting systems.

D. When working in a portion of an occupied building, prevent movement of air from construction area to occupied area.

E. Use of HVAC equipment and ductwork for ventilation during construction is not permitted:
   1. Provide temporary ventilation equivalent to 1.5 air changes per hour, minimum.
   2. Exhaust directly to outside.
   3. Seal HVAC air inlets and outlets immediately after duct installation.

F. HVAC equipment and supply air ductwork may be used for ventilation during construction:
   1. Operate HVAC system on 100 percent outside air, with 1.5 air changes per hour, minimum.
   2. Ensure that air filters are correctly installed prior to starting use; replace filters when they lose efficiency.
   3. Do not use return air ductwork for ventilation.
   4. Do not use return air ductwork for ventilation unless absolutely necessary.
   5. Seal return air inlets or otherwise positively isolate return air system to prevent recirculation of air; provide alternate return air pathways.
   6. Where return air ducts must be used for ventilation, install auxiliary filters at return inlets, sealed to ducts; use filters with at least the equivalent efficiency as those required at supply air side; inspect and replace filters when they lose efficiency.

G. Do not store construction materials or waste in mechanical or electrical rooms.

H. Prior to use of return air ductwork without intake filters clean up and remove dust and debris generated by construction activities.
   1. Inspect duct intakes, return air grilles, and terminal units for dust.
   2. Clean plenum spaces, including top sides of lay-in ceilings, outsides of ducts, tops of pipes and conduit.
   3. Clean tops of doors and frames.
   4. Clean mechanical and electrical rooms, including tops of pipes, ducts, and conduit, equipment, and supports.
   5. Clean return plenums of air handling units.
   6. Remove intake filters last, after cleaning is complete.

I. Do not perform dusty or dirty work after starting use of return air ducts without intake filters.

J. Use other relevant recommendations of SMACNA (OCC) for avoiding unnecessary contamination due to construction procedures.

3.2 BUILDING FLUSH-OUT

A. Construction Manager's Option: Either full continuous flush-out OR satisfactory air contaminant testing is required, not both.

B. Perform building flush-out before occupancy.

C. Do not start flush-out until:
   1. All construction is complete.
   2. HVAC systems have been tested, adjusted, and balanced for proper operation.
   3. Inspection of inside of return air ducts and terminal units confirms that cleaning is not necessary.
   4. New HVAC filtration media have been installed.

D. Building Flush-Out: Operate all ventilation systems at normal flow rates with 100 percent outside air until a total air volume of 14,000 cubic feet per square foot (4500 cubic meters per square meter) of floor area has been supplied.
   1. Obtain Owner's concurrence that construction is complete enough before beginning flush-out.
   2. Maintain interior temperature of at least 60 degrees F (15 degrees C) and interior relative humidity no higher than 60 percent.
   3. If additional construction involving materials that produce particulates or any of the specified contaminants is conducted during flush-out, start flush-out over.
   4. If interior spaces must be occupied prior to completion of the flush-out, supply a minimum of 25 percent of the total air volume prior to occupancy, and:
      a. Begin ventilation at least three hours prior to daily occupancy.
      b. Continue ventilation during all occupied periods.
      c. Provide minimum outside air volume of 0.30 cfm per square foot (0.0015 cu m/s/sq m) or design minimum outside air rate, whichever is greater.

E. Install new HVAC filtration media after completion of flush-out and before occupancy or further testing.

3.3 AIR CONTAMINANT TESTING

A. Construction Manager's Option: Either full continuous flush-out, or satisfactory air contaminant testing is required, not both.

B. Perform air contaminant testing before starting construction, as base line for evaluation of post-construction testing.

C. Perform air contaminant testing before occupancy.

D. Do not start air contaminant testing until:
   1. All construction is complete, including interior finishes.
   2. HVAC systems have been tested, adjusted, and balanced for proper operation.
   3. New HVAC filtration media have been installed.

E. Indoor Air Samples: Collect from spaces representative of occupied areas:
   1. Collect samples while operable windows and exterior doors are closed, HVAC system is running normally as if occupied, with design minimum outdoor air, but with the building unoccupied.
   2. Collect samples from spaces in each contiguous floor area in each air handler zone, but not less than one sample per 25,000 square feet (2300 square meters); take samples from areas having the least ventilation and those having the greatest presumed source strength.

3. Collect samples from height from 36 inches (915 mm) to 72 inches (1830 mm) above floor.
4. Collect samples from same locations on 3 consecutive days during normal business hours; average the results of each set of 3 samples.
5. Exception: Areas with normal very high outside air ventilation rates, such as laboratories, do not need to be tested.
6. When retesting the same building areas, take samples from at least the same locations as in first test.

F. Outdoor Air Samples: Collect samples at outside air intake of each air handler at the same time as indoor samples are taken.

G. Analyze air samples and submit report.

H. Particulate Matter and Inorganic Gases Limits:
1. Carbon Monoxide: Not more than 9 parts per million and not more than 2 parts per million higher than outdoor air.
2. PM10 Particulates: Not more than 20 micrograms per cubic meter.
3. PM2.5 Particulates: Not more than 15 micrograms per cubic meter.
4. PM2.5 Particulates: Not more than 12 micrograms per cubic meter.
5. Ozone: Not more than 0.075 parts per million.
6. Regulated Pollutants: Measure in relation to outside air; not more than contained in outside air.

I. Volatile Organic Compounds Limits:
1. Formaldehyde: Not more than 16.3 parts per billion.
2. Formaldehyde: Not more than 16 parts per billion.
3. Total Volatile Organic Compounds (TVOCs): Not more than 200 micrograms per cubic meter.
4. Chemicals Listed in CAL (CDPH SM) Table 4-1, other than Formaldehyde: Not more than allowable concentrations listed in Table 4-1.
5. Carbon Dioxide: Measure in ppm, in relation to outdoor air; not more than 700 ppm higher than outdoor air.
6. Airborne Mold and Mildew: Measure in relation to outside air; not higher than outside air.
7. Regulated Pollutants: Measure in relation to outside air; not more than contained in outside air.

J. Air Contaminant Concentration Test Methods:
1. Formaldehyde: ASTM D5197, EPA 625/R-96/010b Method TO-11A, or EPA 600/4-90/010 Method IP-6A.
2. Particulates: EPA 600/4-90/010 Method IP-10.
3. Ozone: ASTM D5149.
4. Total Volatile Organic Compounds (TVOC): EPA 625/R-96/010b Method TO-1, TO-15, or TO-17; or EPA 600/4-90/010 Method IP-1.
5. Chemicals Listed in CAL (CDPH SM) Table 4-1, except Formaldehyde: ASTM D5197, or EPA 625/R-96/010b Method TO-1, TO-15, or TO-17.
6. Carbon Monoxide: EPA 600/4-90/010 Method IP-3, plus measure outdoor air; measure in ppm; report both indoor and outdoor measurements.

K. If air samples show concentrations higher than those specified, ventilate with 100 percent outside air and retest at no cost to Owner, or conduct full building flush-out specified above.

3.4 VENTILATION EFFECTIVENESS TESTING

A. Perform ventilation effectiveness testing before occupancy.

B. Do not begin ventilation effectiveness testing until:
1. HVAC testing, adjusting, and balancing has been satisfactorily completed.

2. Building flush-out or air contaminant testing has been completed satisfactorily.
3. New HVAC filtration media have been installed.

C. Test each air handler zone in accordance with ASHRAE Std 129.

D. If calculated air change effectiveness for a particular zone is less than 0.9 due to inadequate balancing of the system, adjust, and retest at no cost to Owner.

3.5 ENVELOPE LEAKAGE TESTING

A. General: Comply with the following procedural requirements for testing building or space envelope, as applicable:
1. ASTM E1827 Standard Test Methods for Determining Airtightness of Buildings Using an Orifice Blower Door.

B. Verify that the envelope to be tested has been sufficiently completed for testing to commence.

C. Conduct ongoing inspections as construction progresses to document satisfactory installation conditions. related to thermal and moisture integrity of the building envelope that become concealed upon completion of construction.

D. Submit a detailed narrative of proposed pressure test procedures prior to the test. Include a plan view showing proposed installation locations (personnel doors or other similar openings) for blower doors (or flexible ducts for trailer-mounted fans, if used).

E. Avoid testing on days forecast to experience high winds, rain, or snow.

F. Test the completed building and demonstrate that the air leakage rate of the building envelope does not exceed the specified requirements.
1. Use equipment and methods necessary to produce indoor/outdoor pressure differential of 0.2 inches w.g. (50 Pa).

G. Determine location and nature of undesirable air leakage pathways using methods specified in ASTM E1186 Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems.

H. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.
1. If difficulty in correction would delay progress, report deficiency to immediately.
2. Insulation for remedying building envelope deficiencies evidenced as excessive air leakage is specified in Section 07 21 00.
3. Air barriers for remedying building envelope deficiencies evidenced as excessive air leakage are specified in Section 07 25 00.
4. Sealants for remedying building envelope deficiencies evidenced as excessive air leakage are specified in Section 07 92 00.

END OF SECTION

SECTION 01 58 13 - TEMPORARY PROJECT SIGNAGE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications and the Sections included under Division 01, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Project Construction Sign.

1.3 REFERENCE STANDARDS

A. FHWA (SHS) - Standard Highway Signs and Markings; 2004, with Supplement (2012).

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 QUALITY ASSURANCE

A. Code Requirement: Project sign shall comply with all applicable Codes, including wind load recommendations and requirements.

B. Design sign and structure to withstand 50 miles/hr (80 km/hr) wind velocity.

C. Sign Painter: Experienced as a professional sign painter for minimum three years.

D. Finishes, Painting: Adequate to withstand weathering, fading, and chipping for duration of construction.

E. Other Site Signs: Unless required by local, state, or Federal Code or safety standards, no other signs will be permitted at the Project site.

1.6 SUBMITTALS

A. Refer to Section 01 30 00.0 - Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 – Product Requirements for substitution procedures.

C. Shop Drawing: Show content, layout, lettering, color, foundation, structure, sizes and grades of members.
   1. Architect will review with the designated Owner’s Representative that the indicated information is correct.
   2. Architect will provide information and design for the Project sign electronically.
   3. Sign fabricator shall be responsible for ensuring that the correct information is indicated on the Project sign.

PART 2 PRODUCTS

2.1 SIGN MATERIALS

A. Structure and Framing: New, wood, structurally adequate.

B. Sign Surfaces: Exterior grade plywood with medium density overlay, minimum 3/4 inch (19 mm) thick, standard large sizes to minimize joints.
   1. Plywood faces shall be constructed into a “V” format on a 90-degree angle.

C. Plywood Sign Faces: 2, 4 ft. x 8 ft.

D. Posts: Not less than 2 posts per 4 ft. x 8 ft. sign face.
   1. Size of Posts: As required per Florida Building Code wind load requirements.
   2. Material: Posts may be fabricated of exterior grade, treated lumber or galvanized steel.

E. Rough Hardware:Galvanized.

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F. Fasteners: Use fasteners that are zinc-coated to inhibit rust.
   1. Number of Fasteners: As required by structural requirements.

G. Paint and Primers: Exterior quality, two coats.

H. Lettering: Exterior quality paint, contrasting colors.

2.2 FABRICATION

A. Project sign shall be fabricated off-site and match the example and brought to the Project site ready for erection in location as directed by Architect.

PART 3 EXECUTION

3.1 INSTALLATION

A. Erect Project sign at the beginning of construction and it shall remain in-place until Certificate of Occupancy has been issued.

B. Erect at designated location. Unless otherwise directed by Owner, Project sign shall be erected at a location that is visible to the public, which typically is adjacent to the entrance drive of the Project site and approved by the Architect.

C. Erect supports and framing on secure foundation, rigidly braced and framed to resist wind loadings.

D. Install sign surface plumb and level, with butt joints. Anchor securely.

E. Paint exposed surfaces of sign, supports, and framing.

3.2 MAINTENANCE

A. Maintain signs and supports clean, repair deterioration and damage.

3.3 REMOVAL

A. Remove signs, framing, supports, and foundations at completion of Project and restore the area.

END OF SECTION

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SECTION 01 60 00.0 - PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; comparable products and substitutiions.

1.3 DEFINITIONS

A. Refer to Section 01 42 16 - Definitions for the following terms:
   1. Product.
      a. Comparable Product.
      b. Named Products.
      c. New Products.
   2. Basis-of-Design Product Specification.
   3. Substitutions.
      a. Substitutions for Cause.
      b. Substitutions for Convenience.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. See 01 30 00.0 - Administrative Requirements for submittal procedures.

B. Transmit each substitution request on company letterhead with completed Form 01 25 00 A. Form.
   1. During bidding phase, substitution requests shall be directed to Project Architect.
   2. During construction phase substitution requests shall be directed to Contractor/CM.

C. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
   1. Include complete information as required in the Substitution Form. Incomplete information will result in automatic rejection of the substitution request.
   2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
      a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
      b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and Contractor, that will be necessary to accommodate proposed substitution.
      c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
      d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.

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e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
h. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
i. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
j. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
k. Cost information, including a proposal of change for a credit to the owner, if any, in the Contract Sum.
l. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.
m. Submittals not requested will not be recognized or processed.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven (7) days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within fifteen (15) days of receipt of request, or seven (7) days of receipt of additional information or documentation, whichever is later.
   a. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.
4. Requests for substitutions shall be made not later than ten (10) calendar days prior to bid date by prospective bidders, or time set by Owner for receipt of GMP (Guaranteed Maximum Price) from CM. Requests received after the above dates may not be considered.
5. Contractor/CM shall submit Product Substitution Request on Form 01 25 00A on following page with transmittal letter and self-addressed stamped envelope for Architect's use in returning response to substitution request.
6. Substitution Form shall identify project, Contractor/CM and Architect during bidding phase plus Subcontractor or supplier during construction phase indicating Specification Section and Paragraph number of specified material and pertinent drawing and detail numbers, as appropriate.
7. Include complete information as required in the Substitution Form. Incomplete information will result in automatic rejection of the substitution request.
8. Apply contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information are in accordance with the requirements of the work and contract documents.
9. Schedule submittals to expedite the project, and deliver to Architect or Contractor/CM at business address. Coordinate submission of related items.
10. For each submittal for review, allow 15 days excluding delivery time to and from Architect or CM/Contractor.
    a. Identify variations from contract documents and product or system limitations, which may be detrimental to successful performance of the completed work.
    b. Provide space for Contractor/CM and Architect review stamps.
    c. When revised for resubmission, identify all changes made since previous submission.
    d. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.
    e. Submittals not requested will not be recognized or processed.

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1.6 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
   1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
   2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

B. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.7 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

1.8 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:
   1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
   2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
   3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
   4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:
   1. Store products to allow for inspection and measurement of quantity or counting of units.
   2. Store materials in a manner that will not endanger Project structure.
   3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
   4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
   5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
   6. Protect stored products from damage and liquids from freezing.
   7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.9 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
   1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
   2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

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B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
   1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
   2. See other Sections for specific content requirements and particular requirements for submitting special warranties.

PART 2 PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
   1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
   2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
   3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
   4. Where products are accompanied by the term "as selected," Architect will make selection.
   5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
   6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:
   1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
   2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
   3. Products:
      a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
      b. Non-restricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.
   4. Manufacturers:
      a. PART 7 Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
      b. Non-restricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.
   5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated

product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
   1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Specification Section "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 SUBSTITUTIONS

A. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
   1. Requested substitution is consistent with the Contract Documents and will produce indicated results.
   2. Substitution request is fully documented and properly submitted.
      a. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
         1) Statement indicating why specified product or fabrication or installation cannot beprovided, if applicable.
         2) Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and Contractors, that will be necessary to accommodate proposed substitution.
         3) Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
         4) Product Data, including drawings and descriptions of products and fabrication and installation procedures.
         5) Samples, where applicable or requested.
         6) Certificates and qualification data, where applicable or requested.
         7) Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
         8) Detailed comparison of Contractor’s construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
         9) Contractor’s certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
         10) Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

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11) Cost information, including a proposal of change for a credit to the owner, if any, in the Contract Sum.
12) Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.
13) Submittals not requested will not be recognized or processed.

3. Requested substitution will not adversely affect Contractor's construction schedule.
4. Requested substitution has received necessary approvals of authorities having jurisdiction.
5. Requested substitution is compatible with other portions of the Work.
6. Requested substitution has been coordinated with other portions of the Work.
7. Requested substitution provides specified warranty.
8. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than fifteen (15) days prior to time required for preparation and review of related submittals.
1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
b. Substitution request is fully documented and properly submitted.
c. Requested substitution will not adversely affect Contractor's construction schedule.
d. Requested substitution has received necessary approvals of authorities having jurisdiction.
e. Requested substitution is compatible with other portions of the Work.
f. Requested substitution has been coordinated with other portions of the Work.
g. Requested substitution provides specified warranty.
h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

C. Substitutions for Convenience: Not allowed unless otherwise indicated.

D. Substitutions for Convenience: Architect will consider requests for substitution if received ten (10) days prior to Bid and within thirty (30) days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.
1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
b. Requested substitution does not require extensive revisions to the Contract Documents.
c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
d. Substitution request is fully documented and properly submitted.
e. Requested substitution will not adversely affect Contractor's construction schedule.
f. Requested substitution has received necessary approvals of authorities having jurisdiction.
g. Requested substitution is compatible with other portions of the Work.

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h. Requested substitution has been coordinated with other portions of the Work.
i. Requested substitution provides specified warranty.
j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
k. Additional requirements as indicated on the Substitution Request Form.

PART 3 EXECUTION

3.1 OWNER-SUPPLIED PRODUCTS

A. See Section 01 10 00 - Summary for identification of Owner-supplied products.

B. Owner's Responsibilities:
1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Construction Manager.
2. Arrange and pay for product delivery to site.
3. On delivery, inspect products jointly with Construction Manager.
4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
5. Arrange for manufacturers' warranties, inspections, and service.

C. Construction Manager's Responsibilities:
1. Review Owner reviewed shop drawings, product data, and samples.
2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
3. Handle, store, install and finish products.
4. Repair or replace items damaged after receipt.

END OF SECTION

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PRODUCT SUBSTITUTION REQUEST (MCSD SUBSTITUTION FORM 01 25 13A)

A. Specified Product _____

B. Sheet No./Specification Section and Paragraph_____

C. Contractor/CM has reviewed and approved proposed substitution? Yes__ No_____

D. Requested Product Substitution: _____

_____

E. Does Product Meet or Exceed Specified Product Requirements? Yes_____No_____
(If answer is no, explain.)_____

F. Does Product Substitution affect dimensions shown on Drawings? Yes_____No_____
(If answer is no, explain.)_____

G. Reason for Requested Substitution:_____

_____

_____

H. Cost Difference between Product Specified and Product Proposed:
Add $ _____Subtract $_____

I. Electrical Requirements equal to Specified Product: Yes_____No_____N/A_____
(If No or N/A, explain):_____

_____

_____

J. Plumbing Requirements equal to Specified Product: Yes_____No_____N/A_____
(If No or N/A, explain):_____

_____

_____

K. Mechanical Requirements equal to Specified Product: Yes_____No_____N/A_____
(If No or N/A, explain):_____

_____

_____

L. Does the Product Substitution have any effect on other trades? Yes_____No_____
(If yes, explain):_____

_____

M. Contractor/CM agrees to pay for changes in building design, including engineering and detailing costs, caused by requested product substitution. Yes_____No_____

N. Signature of Bidder/Contractor/CM shall indicate function, appearance and quality of proposed substitution is equivalent or superior to specified item.

O. Contractor/CM assumes responsibility for delay or claims arising from review and evaluation of requested product substitution.

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P. Approval of proposed substitution shall have no effect on coordination and installation of work in accord with contract documents.

Submitted by: For Use by the Architect and Owner:

_____
Contractor/CM

_____
Firm

_____

_____
Submittal of Information in
Accord with this Section

_____ Received Too Late

_____ Not Accepted

_____ Approved As Noted

_____ Approved For Bidding Only,
Final Approval Contingent Upon Address

_____
Date

_____
Architect Date

_____
Owner Date

END OF SECTION

SECTION 01 70 00 - EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Requirements for alterations work, including selective demolition.

C. Pre-installation meetings.

D. Cutting and patching.

E. Surveying for laying out the work.

F. Cleaning and protection.

G. Starting of systems and equipment.

H. Demonstration and instruction of Owner personnel.

I. Closeout procedures, including Construction Manager's Correction Punch List, except payment procedures.

J. General requirements for maintenance service.

1.3 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2027.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. See Section 01 30 00.0 - Administrative Requirements, for submittal procedures.

B. Survey work:
   1. Employ Land Surveyor registered in State of Florida acceptable to Owner’s Project Manager.
   2. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
   3. Locate and protect survey control and reference points.
   4. Control datum for survey is that established by Owner’s provided survey.
   5. Verify setbacks and easements; confirm drawing dimensions and elevations.
   6. Provide field engineering services. Establish elevations, lines, and levels, utilizing recognized engineering survey practices.
   7. Submit copy of site drawing and certificate signed by Land Surveyor that elevations and locations of Work are in accord with Contract Documents.
   8. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
   9. Submit surveys and survey logs for the project record.
   10. Floor slab verification survey:
      a. Separate from Field Engineering noted above, Contractor/CM shall provide topographic survey of building floor slabs on grade to indicate that finish floor elevations and slab locations are per contract documents, water management and building department requirements.

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b. Survey shall be submitted upon completion of slabs on grade. Remaining work shall not proceed until Owner's Project Manager has reviewed survey information and verified that floor slabs are constructed at proper elevation and locations.
c. Survey shall be prepared, signed and sealed by Florida licensed surveyor, other than the surveyor noted in Para. 1.04 Field Engineering.
d. Surveyor shall be selected form one of Owner's annual surveying vendors. List may be obtained from Owner's Project Manager.

C. Demolition Plan: Submit demolition plan
1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences. Include design drawings and calculations for bracing and shoring.
2. Identify demolition firm and submit qualifications.
3. Include a summary of safety procedures.

D. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
1. Structural integrity of any element of Project.
2. Integrity of weather exposed or moisture resistant element.
3. Efficiency, maintenance, or safety of any operational element.
4. Visual qualities of sight exposed elements.
5. Work of Owner or separate Contractor.
6. Include in request:
a. Identification of Project.
b. Location and description of affected work.
c. Necessity for cutting or alteration.
d. Description of proposed work and products to be used.
e. Alternatives to cutting and patching.
f. Effect on work of Owner or separate Contractor.
g. Written permission of affected separate Contractor.
h. Date and time work will be executed.

E. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.6 QUALIFICATIONS

A. For demolition work, employ a firm specializing in the type of work required.

B. For surveying work, employ a land surveyor registered in Florida and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,

C. For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in Florida. Employ only individual(s) trained and experienced in establishing and maintaining horizontal and vertical control points necessary for laying out construction work on project of similar size, scope and/or complexity.

D. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in Florida.

1.7 PROJECT CONDITIONS

A. Use of explosives is not permitted.

B. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

C. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.

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1. Provide dust-proof enclosures to prevent entry of dust generated outdoors.
2. Provide dust-proof barriers between construction areas and areas continuing to be occupied by Owner.

D. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
   1. At All Times: Excessively noisy tools and operations will not be tolerated inside the building at any time of day; excessively noisy includes jackhammers.
   2. Outdoors: Limit conduct of especially noisy exterior work to the hours of 8 am to 5 pm.
   3. Indoors: Limit conduct of especially noisy interior work to the hours of 6 pm to 7 am.

E. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.
   1. Pest Control Service: Weekly treatments.

F. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.

G. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.8 EXISTING BUILDING PROJECT PROCEDURES

A. Materials: As specified in Product sections; match existing Products and work for patching and extending work.

B. Employ skilled and experienced installer to perform alteration work.

C. Close openings in exterior surfaces to protect existing work from weather and extremes of temperature and humidity.

D. Remove, cut and patch Work in manner to minimize damage and to provide means of restoring Products and finishes to original or specified condition.

E. Refinish existing visible surfaces to remain in renovated rooms and spaces, to specified condition for each material, with neat transition to adjacent finishes.

F. Where new Work abuts or aligns with existing, provide smooth and even transition. Patch Work to match existing adjacent Work in texture and appearance.

G. When finished surfaces are cut so that a smooth transition with new Work is not possible, terminate existing surface along a straight line at natural line of division and submit recommendation to Architect for review.

H. Where change of plane of 1/4" or more occurs, submit recommendation for providing a smooth transition to Architect for review.

I. Patch or replace portions of existing surfaces, which are damaged, lifted, discolored, or showing other imperfections.

J. Work that penetrates fire or smoke rated partitions or floors shall be repaired to provide original fire or smoke rating.

K. Finish surfaces as specified in individual Product Specification Sections.

1.9 COORDINATION

A. See Section 01 10 00 for occupancy-related requirements.

B. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

C. Notify affected utility companies and comply with their requirements.

D. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

E. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

G. Coordinate completion and clean-up of work of separate sections.

H. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.1 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

C. Substitutions: See Section 01 60 00.0 - Product Requirements for substitution procedures.

2.2 EQUIPMENT ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Motors: Refer to Electrical Sections for specific motor types.

B. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Size terminal lugs to NFPA 70, include lugs for terminal box.

C. Cord and Plug: Provide minimum 6' cord and plug including grounding connector for connection to electric wiring system. Cord of longer length is specified in individual specification sections.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.2 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

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3.3 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section.

C. Notify Architect four days in advance of meeting date.

D. Prepare agenda and preside at meeting:
   1. Review conditions of examination, preparation and installation procedures.
   2. Review coordination with related work.

E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.4 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Architect of any discrepancies discovered.

C. Owner will locate and protect survey control and reference points.

D. Control datum for survey is that established by Owner provided survey.

E. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

F. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

G. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.

H. Utilize recognized engineering survey practices.

I. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
   1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations; and _____.
   2. Grid or axis for structures.
   3. Building foundation, column locations, ground floor elevations, and _____.

J. Periodically verify layouts by same means.

K. Maintain a complete and accurate log of control and survey work as it progresses.

3.5 GENERAL INSTALLATION REQUIREMENTS

A. In addition to compliance with regulatory requirements, conduct construction operations in compliance with NFPA 241.

B. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

C. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

D. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

E. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

F. Make neat transitions between different surfaces, maintaining texture and appearance.

3.6 ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as indicated.

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2. Report discrepancies to Architect before disturbing existing installation.
3. Beginning of alterations work constitutes acceptance of existing conditions.

B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
   1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 50 00 in locations indicated on drawings.

C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
   1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
   2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.

D. Remove existing work as indicated and as required to accomplish new work.
   1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
   2. Remove items indicated on drawings.
   3. Relocate items indicated on drawings.
   4. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
   5. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.

E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
   2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
   3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
      a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
      b. Provide temporary connections as required to maintain existing systems in service.
   4. Verify that abandoned services serve only abandoned facilities.
   5. Remove abandoned pipe, ducts, conduits, and equipment , including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

F. Protect existing work to remain.
   1. Prevent movement of structure; provide shoring and bracing if necessary.
   2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.

G. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
   1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect.

2. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
3. Where a change of plane of 1/4 inch (6 mm) or more occurs in existing work, submit recommendation for providing a smooth transition for Architect review and request instructions.

H. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.

I. Refinish existing surfaces as indicated:
1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.

J. Clean existing systems and equipment.

K. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.

L. Do not begin new construction in alterations areas before demolition is complete.

M. Comply with all other applicable requirements of this section.

3.7 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. See Alterations article above for additional requirements.

C. Perform whatever cutting and patching is necessary to:
1. Complete the work.
2. Fit products together to integrate with other work.
3. Provide openings for penetration of mechanical, electrical, and other services.
4. Match work that has been cut to adjacent work.
5. Repair areas adjacent to cuts to required condition.
6. Repair new work damaged by subsequent work.
7. Remove samples of installed work for testing when requested.
8. Remove and replace defective and non-complying work.

D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

E. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

G. Restore work with new products in accordance with requirements of Contract Documents.

H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 84 00, to full thickness of the penetrated element.

J. Patching:
1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

2. Match color, texture, and appearance.
3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.8 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.9 PROTECTION OF INSTALLED WORK

A. General:
   1. Protect finished surfaces, including doors, door jambs, soffits of openings used as passageways, through which equipment and materials are handled.
   2. Protect finished floor surfaces in traffic areas prior to allowing equipment or materials to be moved.
   3. Keep finished surfaces clean, unmarked, and suitably protected until Owner’s project acceptance.

B. Protect installed work from damage by construction operations.

C. Provide special protection where specified in individual specification sections.

D. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

E. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

F. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

G. Protect work from spilled liquids. If work is exposed to spilled liquids, immediately remove protective coverings, dry out work, and replace protective coverings.

H. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

I. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.10 SYSTEM STARTUP

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify Architect and Owner seven days prior to start-up of each item.

C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

E. Verify that wiring and support components for equipment are complete and tested.

F. Execute start-up under supervision of applicable Construction Manager personnel and manufacturer's representative in accordance with manufacturers' instructions.

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G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

H. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.11 DEMONSTRATION AND INSTRUCTION

A. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of Substantial Completion.

B. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.

C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

D. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of Owner's personnel.

E. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.

F. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

3.12 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

B. Testing, adjusting, and balancing HVAC systems: See Division 23 for testing, adjusting, and balancing for HVAC information.

3.13 REPAIRS AND REPLACEMENTS

A. Promptly replace or repair damaged equipment or building surfaces caused by moving equipment at no additional cost to Owner.

B. Additional time required to repair or replace damaged equipment or building surfaces shall not be grounds for Contract time extension or Contractor’s additional expense, unless Owner specifically authorizes time extension or additional costs.

3.14 FINAL CLEANING

A. Execute final cleaning prior to final project assessment.
   1. Clean areas to be occupied by Owner prior to final completion before Owner occupancy.

B. Use cleaning materials that are nonhazardous.

C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

F. Clean filters of operating equipment.

G. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.

H. Clean site; sweep paved areas, rake clean landscaped surfaces.

I. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

J. Keep finished surfaces clean, unmarked, and suitably protected until Owner’s project acceptance.

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3.15 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.
   1. Provide copies to Architect and Owner.

B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Construction Manager's Correction Punch List for Construction Manager's Notice of Substantial Completion.

C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.

D. Submit written certification containing Construction Manager's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.

E. Owner will occupy all of the building as specified in Section 01 10 00.

F. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Construction Manager's comprehensive list of items identified to be completed or corrected and submit to Architect.

G. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.

H. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.

I. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

3.16 MAINTENANCE

A. Provide service and maintenance of components indicated in specification sections.

B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.

C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION

SECTION 01 73 20 - INDOOR AIR QUALITY (IAQ) MANAGEMENT PLAN

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Section includes general requirements and procedures for achieving acceptable indoor air quality for the interior areas of this Project during construction, and preventing contamination of ductwork, HVAC equipment, and other building materials to avoid IAQ problems for workers and for occupants in the future after occupancy. Work includes requirements on the use of permanent building mechanical systems prior to Owner's acceptance.

B. Contractor shall prepare and submit an Indoor Air Quality (IAQ) Management Plan.

1.3 REFERENCE STANDARDS

A. ANSI/SMACNA 008 - IAQ Guidelines for Occupied Buildings Under Construction; Current Edition.

B. SMACNA (IAQ) - IAQ Guidelines for Occupied Buildings Under Construction; Current Edition.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements, for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 - Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 - Product Requirements for substitution procedures.

C. IAQ Construction Management Plan: Submit 3 Copies of the plan within 30 days of the date established for commencement of the Work. Update and resubmit plan as required during construction process to reflect Project conditions.

D. Meeting Minutes: Submit minutes from the Contractor meetings related to the execution and verification of the IAQ Construction Management Plan.

E. Product Data: Submit cut sheets of filtration media proposed for use.

1.6 QUALITY ASSURANCE

A. Contractor's Construction IAQ Management Plan shall meet or exceed the 5 recommended design approaches of SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction 2nd Edition 2007, ANSI/SMACNA 008-2008, (Chapter 3), and shall embody the principals and practices set forth in this Section.

B. IAQ Management Conference: Conduct conference at Project site to comply with the requirements in Division 1 Section "Project Management and Coordination."
   1. Review methods and procedures related to IAQ management during construction.
   2. Review IAQ management requirements with each trade.

1.7 IAQ CONSTRUCTION MANAGEMENT PLAN

A. Contractor IAQ Construction Management Plan shall include procedures to prevent indoor air quality problems resulting from the construction process in order to help sustain the comfort and well being of construction workers and future building occupants.

B. Contractor's detailed plan shall be based on the particular characteristics of the Project.

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PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 HVAC PROTECTION (SMACNA APPROACH NUMBER 1)

A. Store HVAC equipment including but not limited to items such as ducting, registers, air handler components, fans, and motors in a clean, dry location, protected from dust and other contaminants, and covered with plastic until installed.

B. Seal all HVAC inlets and outlets.

C. Use of the HVAC system shall be avoided during construction, until drywall construction and activities that produce dust or particulate pollution have been completed. Temporary ventilation may be installed to remove contaminants. All HVAC components including but is not limited to outside air inlets, grills, diffusers, supply ducts, return ducts, ceiling plenums, VAV (variable air volume) plenum intakes, and window ventilator or air conditioning units shall be sealed during construction.

D. Seal HVAC components during installation. Duct runs that require several days to install, sections shall be sealed off as they are completed. Seals shall be removed prior to continuing the duct run. Other components of the HVAC system shall be subject to the same requirements to protect from contamination.

E. Provide frequent inspection and maintenance, of HVAC component protection. Replace as necessary. If inspections by the Architect, Engineer, Owner, or Commissioning Agent reveal that the ductwork has been contaminated due to inadequate protection, the ductwork shall be cleaned professionally prior to activation the HVAC system or occupancy, using procedures established in ACR 2005 published by the National Air Duct Cleaners Association. HVAC components have been damaged or contaminated shall be cleaned or replaced as necessary.

F. Use temporary filtration media. If HCAC system is to be used while construction work is being done, temporary media filtration media shall be installed on all air intakes. Such filtration shall have a minimum filtration efficiency (Minimum Efficiency Reporting Value-MERV per ASHRAE 52.2) of 8. For air intakes into other parts of the building that are very sensitive, such as computer rooms, filtration media with a MERV rating of 13 or higher is required.

G. Inspect filters weekly replace as needed for proper filtration and air flow.

H. Avoid contamination of air entry into enclosed parts of the building. When outdoor construction activities generate dust, combustion emissions, or other contaminates, operable windows and outside air supplies to enclosed portions of the building will be closed or sealed.

I. Do not use fan, mechanical, or electrical rooms to store construction or waste materials. Keep these rooms clean and neat.

J. Ceiling tiles shall not be installed until after drywall and painting is complete to avoid contamination of ceiling tiles that will form the return air plenum.

3.2 SOURCE CONTROL (SMACNA APPROACH NUMBER 2)

A. The use of moisture-damaged materials shall not be allowed. Any porous materials that have become wet shall be dried thoroughly within 48 hours and before installation. Any materials damaged, showing visible mold, or that are wet for over 48 hours shall be removed from the site appropriately.

B. Contractor to ensure that the construction process will not result in moisture intrusion. In the event of rain or groundwater intrusions notify the Owner’s representative.

C. Avoid tracking pollutants into the work areas.
   1. At the start of framing and mechanical system installation access to the building shall be controlled to minimize the tracking of contaminants.
   2. Material deliveries and construction waste removal shall be routed by the most direct route to and from the building exterior.

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3. Provide rough track off grates or matting at the entryway to remove moisture and contaminants from pedestrian traffic.
4. Prevent the ingress of rodents and pests.
5. Food and drinks other than water shall not be allowed in the building.
6. Trash containers will be primarily located outside of the building. Any interior trash containers will be emptied twice a week at a minimum.
7. Use procedures to insure that there is no smoking in the building, storage areas of absorptive materials, or within 25 ft of air intakes or building openings.

D. Limit construction traffic and monitor idling vehicles and equipment in the vicinity of air intakes when the HVAC systems are activated. Restrict vehicles to a loading area, well removed from air intakes. Prevent emissions from being drawn into the building.

E. Use electric or natural gas alternatives to for gasoline and diesel equipment when possible.

F. All personnel lifts used inside the building will be electrically operated to prevent emissions inside the building.

G. Cycle vehicles and equipment off when not being used.

H. Avoid the use of materials and products with high VOC and particulate levels. Inside the building use products and installation methods with low VOCs such as paints and coatings, adhesives and sealants, and cleaners.

I. Keep containers of wet products closed when not in use. Cover and seal materials which can release odor or dust.

J. Containers of fuel, volatile liquids, and materials with high VOC content shall be tightly sealed and stored outside of the building.

K. Protect absorbent materials from moisture during delivery to and storage at the job site. Store materials in a dry and clean environment.

3.3 PATHWAY INTERUPTION (SMACNA APPROACH NUMBER 3)

A. Use dust curtains or temporary enclosures to prevent dust from migrating to other areas when applicable. During construction, isolate areas of work to prevent contamination of clean or occupied areas.

B. Keep pollutant sources as far away as possible from absorptive materials, ductwork, and areas occupied by workers.

C. Isolate work areas and or create pressure differentials to prevent the migration of contaminants.

D. Use portable fan systems to exhaust contaminated air directly to the outside of the building, and discharge the air to prevent recirculation.

3.4 HOUSE KEEPING (SMACNA APPROACH NUMBER 4)

A. Keep HVAV components, not limited to coils, air filters, dampers, fans, and ductwork, clean during installation, and clean them as required prior to performing the testing, adjusting and balancing of the systems.

B. Construction shall minimize the production and accumulation of dust and other contaminants. Use integral dust collection systems on drywall sanders, cut saws, and routers. Confine dust-generation activities to areas where cleaning can be carried out easily and where contaminants will not be tracked or contaminate other areas.

C. Wetting agents or sweeping compounds shall be used to keep dust from becoming airborne.

D. Wet cloths, damp mops, and vacuum cleaners with high efficiency particulate (HEPA) filters shall be used to clean. Cleaning frequency shall be increased when dust accumulation is noted.

E. All spills and excess applications of solvent-containing products shall be cleaned using approved methods immediately. Water spills shall be cleaned-up promptly.

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F. Avoid accumulation of water inside the building and promptly remove any water that may occur. Protect porous materials such as insulation, ceiling tiles and drywall from water or moisture.

G. Construction areas shall be kept dry. Promptly repair any leaks or penetrations that allow water to enter the building. Use dehumidification as necessary for prompt drying of wet surfaces and materials.

H. Clean rough track off grates or matting at the entryway as necessary, at a minimum weekly to reduce dirt and particulates from entering the building, when building is enclosed.

I. Cleaning Agents: Use Cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces. Use cleaning products that meet Green Seal GS-37, or if GS-37 is not applicable use products that comply with the California Code of Regulations maximum allowable VOC levels.

3.5 SQUENCING AND SCHEDULING (SMACNA APPROACH NUMBER 5)

A. Schedule the installation of porous materials after enclosure of the building. Porous materials shall not be installed until the building envelope is fully weather tight.

B. Install porous or absorbent materials such as ceiling tiles, after odorous activities including drywall installation, painting, and floor finishing is completed.

C. Do not allow contaminants from an area under construction to enter the HVAC systems or to migrate to completed areas of construction.

D. Install new MERV 8 filters prior to the FF&E move-in and occupancy.

E. Install furnishing after interior finishes have applied and fully cured.

F. Provide adequate ventilation during curing period. To aid in curing of interior finishes and other products used during construction and to remove pollutants after drywall installation is complete provide adequate ventilation with 100% outside air, and proper filtration for any HVAC components activated. During humid periods or when high moisture materials are present, supplementary dehumidification may be required.

G. All sanding of the concrete floors, floor preparation, and the poured-in-place terrazzo will be scheduled before the HVAC system startup.

H. All drywall sanding and painting will be scheduled before the HVAC system startup.

I. Move-in of all FF&E will occur after all construction activities have been substantially completed and the HVAC has been tested and balanced.

3.6 MONITORING AND IMPLEMENTATION OF IAQ PLAN

A. Contractor to designate an on-site responsible staff member for instructing personnel and overseeing the Construction IAQ Management Plan.

B. Provide weekly Contractor site co-ordination meetings with subcontractors. Review appropriate components of the IAQ Construction Management Plan as a regular action item. Document the implementation of the Plan in the meeting minutes and update the IAQ Construction Management Plan as required.

C. Subcontractors and their employees shall be provided instruction and Training in the Indoor Air Quality (IAQ) Management Plan.

D. Recording format: Use SMACNA (IAQ) Guidelines Appendix C (Planning Checklist) and Appendix D (Inspection Checklist) as a guide.

E. Project-specific posters and signage will be posted in the jobsite office trailer, at all building entrances, and at several locations inside the building. The signage will clearly identify guidelines for subcontractors.

END OF SECTION

SECTION 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Administrative and procedural requirements for the following:
   1. Disposing of non-hazardous waste.

1.3 DEFINITIONS

A. Refer to Section 01 42 16 - Definitions for the following terms:
   1. Construction Waste.
   2. Demolition Waste.
   3. Disposal.
   4. Recycle.
   5. Salvage.
   6. Salvage and Reuse.

1.4 REFERENCES

A. Refer to specification Section 014100 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications: Firm having minimum 10 years documented experience in specializing in waste management coordination.

B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Monitor each trade, product suppliers, product deliveries, waste generation, site conditions, and workmanship, to minimize waste and maximize recycled materials and reuse of retained materials.

1.6 PERFORMANCE REQUIREMENTS

A. Conform to applicable regulations regarding Solid Waste Control.

B. Practice efficient waste management in the use of materials in the course of the Work.

1.7 WASTE MANAGEMENT PLAN

A. Develop a waste management plan and requirements.
   1. Submit plan within 20 days of date established for Notice to Proceed.
   2. Submit MSDS sheets for products requiring special care or handling in storage, application or cleanup.
   3. Submit Waste Management and Cleaning Plans identifying and providing operational procedures for each item noted in Scope of Work.
   4. Coordinate scheduling and implementation of Waste Management and Cleaning Plans with each trade on site.
   5. Ensure enforcement to promote efficient and orderly sequence of installation of interdependent construction elements, with intent to reduce waste maximize efficient and safe work environment.
   6. Coordinate periodic and final clean up of Work of each trade in preparation for Substantial Completion and for portions of Work designated for Owner's partial occupancy.

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PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 PLAN IMPLEMENTATION

A. Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract:
   1. Comply with operation, termination, and removal requirements in Section 01 50 00 - Temporary Facilities and Controls.

B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.

C. Site Access and Temporary Controls:
   1. Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities:
      a. Comply with Section 01 50 00 - Temporary Facilities and Controls for the control of dust and dirt, environmental protection, and noise control.

3.2 DISPOSAL OF WASTE

A. Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction:
   1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Remove waste materials and dispose of at designated spoil areas on Owner's property.

END OF SECTION

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SECTION 01 78 00 - CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Project record documents.

B. Operation and maintenance documentation directory manuals.

C. Emergency manuals.

D. Operation and maintenance data.

E. Warranties and bonds.

1.3 SUBMITTALS

A. Submit written certification that contract documents were reviewed, work inspected, and that work is complete in accord with contract documents and ready for Owner’s Project Manager and AE’s review.

B. Provide submittals to AE and Owner’s Project Manager that are required by building and fire authorities.
   1. Submit final application for payment identifying total adjusted contract sum, previous payments, and sum remaining due.
   2. Owner may opt to occupy all or portions of completed facilities upon substantial completion of those portions of work.
   3. Contractor/CM shall provide punch list to AE identifying items remaining to be completed.
   4. AE shall inspect project to determine completion of punch list and project compliance with Contract Documents.

C. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.

D. Operation and Maintenance Data:
   1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
   2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
   3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
   4. Submit two sets of revised final documents in final form within 10 days after final inspection.

E. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

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PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 PROJECT CLOSE-OUT PROCEDURES

A. Items are to be submitted to the School District's Construction Manager's Office once the request for final payment has been submitted.
   1. ____4 Copies: AIA Application For Payment, Signed and Sealed, Noted as Final Payment.
   2. ____Consent of Surety to make final payment.
   3. ____Release of Lien from all Sub-Contractors or Laborers who have filled an Intent to Lien.
   4. _____Warranty/Guarantee from Construction Manager for one-year from the date of Substantial Completion.
   5. ____Warranty/Guarantee from each Sub-Contractor for one-year from the date of Substantial Completion.
   6. _Copy of the approval by the Architect-Engineer and the transmittal to the end user of manuals, shop drawings, as-builds, brochures, warranties, list of sub-contractors with phone numbers, addresses and contact persons.
   7. ____Verification that all applicable district personnel have been trained in the operation of their new equipment (per system: HVAC, controls, etc.)
   8. ____Executed Roof Warranty in the name of the Martin County School District.
   9. ____4 Copies: OEF Form 209, Certificate of Final Inspection.
   10. ____4 Copies: Completed Punch-list.
   11. ____SREF 4.2(3)(e) Architect's Certificate of Specification of Asbestos Containing Materials.
   12. ____SREF 4.2(3)(e) Contract's Certificate of Asbestos Use.
   13. ____SREF 4.2(3)(d) Threshold inspector's statement that building complies with Threshold Plan.
   14. _____4 Copies: OEF Form 110B, Certificate of Occupancy.
   15. _____OEF Form 564 for new construction or additions to existing schools only (Return to Director's Secretary)
   16. ____Inspection Log Book

3.2 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed shop drawings, product data, and samples.
   6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Measured depths of foundations in relation to finish first floor datum.
   2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
4. Field changes of dimension and detail.
5. Details not on original Contract drawings.

G. Upon project completion, transfer project record drawing information to Autocad (2010 or later format) files and provide four copies of CD's to Architect for review and transmitted to Owner, prior to claim for final Application for Payment.

H. Contractor/CM shall also submit two hard copies of record drawings and project manual maintained during project to Owner's Project Manager.

I. Owner will be responsible for making prints from CD's and for their distribution to Owner's user groups.

3.3 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

A. Operation and Maintenance Documentation Directory:
1. Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:
a. List of systems and subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
b. List of equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
c. Tables of contents: Include a table of contents for each emergency, operation, and maintenance manual.

3.4 EMERGENCY MANUALS

A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

B. Content:
1. Organize manual into a separate section for each of the following:
a. Type of emergency.
b. Emergency instructions.
c. Emergency procedures.

C. Type of Emergency:
1. Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
a. Flood.
b. Gas leak.
c. Water leak.
d. Power failure.
e. Water outage.
f. System, subsystem, or equipment failure.
g. Chemical release or spill.

D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

E. Emergency Procedures:
1. Include the following, as applicable:
a. Instructions on stopping.
b. Shutdown instructions for each type of emergency.
c. Operating instructions for conditions outside normal operating limits.

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d. Required sequences for electric or electronic systems.
e. Special operating instructions and procedures.

3.5 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.6 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:
   1. Product data, with catalog number, size, composition, and color and texture designations.
   2. Information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

D. Additional information as specified in individual product specification sections.

E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.7 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:
   1. Description of unit or system, and component parts.
   2. Identify function, normal operating characteristics, and limiting conditions.
   3. Include performance curves, with engineering data and tests.
   4. Complete nomenclature and model number of replaceable parts.

B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

D. Include color coded wiring diagrams as installed.

E. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

F. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
   1. Include HVAC outdoor and exhaust air damper calibration strategy.
   2. Include provisions which ensure that full closure of dampers can be achieved.
   3. Include Carbon Dioxide Monitoring Protocol.

4. Include Carbon Monoxide Monitoring Protocol.
5. Include Frost Mitigation Strategy for ventilation heat-recovery system.

G. Provide servicing and lubrication schedule, and list of lubricants required.

H. Include manufacturer's printed operation and maintenance instructions.

I. Include sequence of operation by controls manufacturer.

J. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

K. Provide control diagrams by controls manufacturer as installed.

L. Provide Construction Manager's coordination drawings, with color coded piping diagrams as installed.

M. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

N. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

O. Include test and balancing reports.

P. Additional Requirements: As specified in individual product specification sections.

3.8 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

B. Where systems involve more than one specification section, provide separate tabbed divider for each system.

C. Binders: Commercial quality, 8-1/2 by 11 inch (216 by 280 mm) three D side ring binders with durable plastic covers; 2 inch (50 mm) maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Construction Manager and subcontractors, with names of responsible parties.

F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.

G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.

H. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.

I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

J. Arrangement of Contents: Organize each volume in parts as follows:
   1. Project Directory.
   2. Table of Contents, of all volumes, and of this volume.
   3. Operation and Maintenance Data: Arranged by system, then by product category.
      a. Source data.
      b. Product data, shop drawings, and other submittals.
      c. Operation and maintenance data.
      d. Field quality control data.

e. Photocopies of warranties and bonds.

4. Design Data: To allow for addition of design data furnished by Architect or others, provide a tab labeled "Design Data" and provide a binder large enough to allow for insertion of at least 20 pages of typed text.

3.9 MAINTENANCE SERVICE

A. Furnish service and maintenance of components indicated in specification sections for one-year from date of project substantial completion.

B. Examine, clean, adjust, and lubricate system components as required for reliable operation.

C. Include systematic examination, adjustment, and lubrication of components repairing or replacing parts as required with parts produced by the manufacturer of the original component.

D. Owner shall approve in writing of transfers or reassignments of maintenance service tasks.

3.10 ASBESTOS CERTIFICATION

A. Provide notarized letter from Contractor/CM certifying that “to the best of his/her knowledge no asbestos containing building materials were used as a building material in the project”, per FS 255.40.

3.11 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Provide spare parts, maintenance, and extra products in quantities specified in specification.

B. Deliver to Owner; obtain receipt prior to final payment.

C. Use only maintenance products approved for use in Florida Educational Facilities.

3.12 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.13 FINAL CLEANING

A. Execute final cleaning prior to final project assessment.

B. Clean interior and exterior surfaces exposed to view; remove temporary labels, stains and foreign substances.

C. Clean equipment and fixtures to sanitary condition with cleaning materials per manufacturer’s written recommendations.

D. Remove waste and surplus materials, rubbish, and construction facilities from the site.

E. Use only cleaning products approved for use in Florida Educational Facilities.

3.14 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

B. Form of Submittals
   1. Prepare in duplicate packets.
   2. Submit documentation as noted in individual product specifications and as noted herein.
   3. Provide duplicate notarized copies.
   4. Execute and assemble transferable warranty documents from subcontractors, suppliers, and manufacturers.
   5. Provide Table of Contents and assemble in D-side 3-ring white binders with typed title sheet of contents inside durable plastic front cover.
   6. Submit prior to final application for payment.
   7. For items of work delayed beyond date of substantial completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

8. Format:
    a. Size: 8-1/2" x 11" punch sheets for standard 3-ring binder:
        1) Fold larger sheets to fit into binders.
    b. Cover: Identify each packet with typed or printed title "WARRANTIES AND BONDS". List:
        1) Title of Project.
        2) Location of Project.
        3) Name of Construction Manager.
9. Binders: Commercial quality, 3-ring, with durable and cleanable plastic covers, all of same color.

C. Verify that documents are in proper form, contain full information, and are notarized.

D. Time of Submittals
1. For equipment or component parts of equipment put into service during progress of construction:
    a. Warranties shall start at the Date of Substantial Completion for each phase of work complete for the items related to that particular phase. The final warranties for the project will list the individual dates for the start date of each warranty per phase.
        1) Submit documents as indicated with Closeout Documents.
2. For items of work where acceptance is delayed materially beyond Date of Substantial Completion, provide updated submittal within ten (10) days after acceptance, listing date of acceptance as start of warranty period.

E. Retain warranties and bonds until time specified for submittal.

END OF SECTION

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MARTIN COUNTY SCHOOL DISTRICT

FACILITIES/PLANNING/CONSTRUCTION
1050 SE 10TH STREET
Stuart, FL 34994

Date: _ _,_

MCSD Project Close-Out Form

Project School
Project Title
Architect's Project No. -

Item #	Status	Close-Out Item
1		3 Copies: Application For Payment, Signed and Sealed, Noted as Final Payment.
2		Consent of Surety to make final payment.
3		Release of Lien from all Sub-Contractors or Laborers who have filled an Intent to Lien.
4		Warranty/Guarantee from Construction Manager for one-year from the date of Substantial Completion.
5		Warranty/Guarantee from each Sub-Contractor for one-year from the date of Substantial Completion.
6		Copy of the approval by the Architect-Engineer and the transmittal to the end user 1. manuals, 2.shop drawings, 3.full set of record drawings, 4.brochures, 5.warranties, 6.list of sub-contractors with phone numbers, addresses and contact persons.
7		Verification that all applicable district personnel have been trained in the operation of their new equipment (per system: HVAC, controls, etc.)
8		Executed Roof Warranty in the name of the Martin County School District.
9		OEF Form 209, Certificate of Final Inspection.
10		Completed Punch-list.
11		SREF 4.2(3)(e) Architect's Certificate of Specification of Asbestos Containing Materials.
12		SREF 4.2(3)(e) Construction Manager's Certificate of Asbestos Use.
13		SREF 4.2(3)(d) Threshold inspector's statement that building complies with Threshold Plan.
14		OEF Form 110B, Certificate of Occupancy.
15		OEF Form 564 for new construction or additions to existing schools only
16		Contractor's Inspection Log Book
17		One copy of the Previous FISH Bldg. Plans & Site Plan and One copy of the Current FISH Bldg. Plans & Site Plan : (1) PDF Copy and Acad Files.

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18		Please submit one PDF copy of each item listed above by email, thumb drive or CD to the Facilities Department.

SECTION 01 91 00 - COMMISSIONING

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Administrative and procedural requirements for commissioning facilities and facility systems.

B. Demonstration and training.

C. Starting systems.

D. Demonstration and instructions.

1.2 STARTING SYSTEMS

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify Architect and Owner seven days prior to startup of each item.

C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, or other conditions which may cause damage.

D. Verify that tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

E. Verify wiring and support components for equipment are complete and tested. Execute startup under supervision of responsible Contractors' personnel in accordance with manufacturers' instructions.

F. When specified in individual specification sections, require manufacturer to provide authorized representative to be present at site to inspect, check and approve equipment or system installation prior to startup, and to supervise placing equipment or system in operation.

G. Submit written reports per section 01 78 00 - Execution and Closeout Documents that equipment or system is installed and functioning correctly.

1.3 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of Products to Owner's personnel two weeks prior to date of Substantial Completion.

B. Demonstration of equipment shall be performed by qualified manufacturers' representative who is knowledgeable about the Project and equipment.

C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

D. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owners' personnel in detail to explain all aspects of operation and maintenance.

E. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed-upon times, at equipment location.

F. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

G. Amount of time required for instruction in each piece of equipment and system is indicated in individual equipment and system specification sections.
   1. TESTING, ADJUSTING, AND BALANCING

H. Contractor/CM shall employ, and pay for commissioning services other than TAB firm to perform testing, adjusting and balancing of other systems as indicated or require for fully functional systems

I. Independent TAB firm shall perform services specified in section 23 05 93 – Testing, Adjusting, and Balancing for HVAC system(s).

J. The Contractor/CM shall submit reports to Architect indicating observations, results of tests and compliance or non-compliance with specified requirements and with requirements of contract documents.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 LIST OF EQUIPMENT TO BE COMMISSIONED

A. Communications System
B. Fire Alarm System
C. Intercom System
D. Kitchen Equipment
E. HVAC Equipment.
F. Gymnasium Equipment including bleachers, scoreboards, basketball backstops, sound system, playcourt surface, equipment with floor inserts
G. Lighting Systems
H. Stage, Auditorium, Gym and Instructional Spaces Sound Reinforcement Systems
I. Irrigation System
J. Fire Protection System
K. Movable Interior Partitions
L. Emergency Generator

3.2 EQUIPMENT COMMISSIONING REQUIREMENTS

A. Comply with individual specification sections for equipment start-up, operation and training.

END OF SECTION

SECTION 01 91 01 - COMMISSIONING OF HVAC

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Independent commissioning of heating, ventilation, and air conditioning in accord with project documents and include:
   1. Evaluate proposed HVAC and electrical systems design and control system documents.
   2. Review and document HVAC and Electrical control interface systems interface.
   3. Coordinate start-up of HVAC and Electrical systems.
   4. Coordinate and review operation, training procedures, demonstration and instructions for HVAC equipment use by Owner.
   5. Review, evaluate and document HVAC equipment operation and performance.

B. Work with TAB contractor for testing, adjusting, and balancing to ensure HVAC system performance is maximized for operational efficiency.

C. Coordinate HVAC Commissioning scheduling and activities with GC/CM.

D. Commissioned Systems Include:
   1. HVAC components and equipment.
   2. HVAC interaction of cooling, heating, and comfort delivery systems.
   3. Building Automation System (BAS): control hardware and software, sequences of operation, and integration of factory controls with BAS.
   4. Plumbing: Domestic hot water systems.
   5. Lighting Control System with interface with daylighting.

1.2 REFERENCE STANDARDS

A. See Section 01 42 00 – References for additional reference standards, definitions, abbreviations and acronyms.

B. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE):
   1. ASHRAE Guideline 0-2005 with Amendments a, b, c & d - The Commissioning Process.
   2. ASHRAE Guideline 1.1-2007, The HVAC Commissioning Process.
   3. ASHRAE 110-95 – An Introduction to Laboratory Fume Hood Performance Testing.

C. NEBB Whole Building Systems Commissioning of New Construction, 2009 (3rd Edition).

D. American National Standards Institute/American Industrial Hygiene Association/American Society of Safety Engineers (ANSI/AIHA/ASSE):
   1. ANSI/AIHA/ASSE Z9.5-2012 – American National Standard for Laboratory Ventilation.

1.3 DEFINITIONS

A. Definition of terms used are as follows:
   1. Acceptance Phase: Phase of construction after initial start-up and check-out when functional performance testing, operational training, and operating and maintenance documentation development and review occurs.
   2. Basis of Design: Documentation of primary thought processes and assumptions for design decisions made to meet Owner's Project Requirements as reflected in construction documents (drawings and specifications). Basis of design describes intent of project, systems, components, conditions, and methods chosen to meet Owner's Project Requirements. Design professionals (Architect and Engineer) are responsible for interpretation of the basis of design.
   3. Commissioning Provider: Independent entity, not otherwise associated with design team or Contractor/CM, who directs and coordinates day-to-day commissioning activities. Commissioning Provider does not have construction oversight or design role.

4. Commissioning Plan: Overall plan providing structure, schedule, and coordination planning for commissioning process.
5. Commissioning Team: Group responsible for accomplishing commissioning process.
6. Data Logging: Monitoring flows, currents, status, and pressures of equipment using stand-alone recording equipment, separate from control system. Additional monitoring may be provided through capabilities of control system.
7. Deferred Functional Performance Tests: Functional tests performed after date of substantial completion due to partial occupancy, equipment and seasonal testing requirements, design or other site conditions precluding testing of system or piece of equipment during normal commissioning sequence.
8. Owner's Project Requirements: Documents prepared by Owner providing explanation of
   a. concepts, criteria, and work scope critical to Owner’s expectations.
9. Factory Testing: Testing of equipment at factory (or on-site) by factory personnel in
   a. Owner’s representative and commissioning agent’s presence.
10. Functional Performance Tests: Tests of dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Functional testing is dynamic testing of systems (rather than just components) under full operation. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied modes, varying outside air temperatures, fire alarm modes, and power failure. Systems are run through control system’s sequences of operation and components are verified to respond properly. Commissioning Provider develops Functional Performance Test procedures in sequential written form, coordinates, oversees and documents actual testing performed by GC/CM. Functional Performance Tests are performed after Test and Balance, pre-functional checklists and start-up is complete.
11. Indirect Indicators: Indicators of response or condition, such as reading from control system screen reporting damper to be 100% closed.
12. Manual Tests: Using hand-held instruments, immediate control system read-outs or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make observations.
13. Monitoring: Recording of parameters (flow, current, status, or pressure) of equipment operation using data loggers or trending capabilities of control systems.
14. Over-written Value: Writing over sensor value in control system to determine response of system (e.g., changing outside air temperature value from 50ºF to 75ºF to verify economizer operation). See “Simulated Signal.
15. Owner-contracted Tests: Tests paid by Owner outside GC/CM’s contract and for which Commissioning Provider does not oversee. Tests shall not be repeated during functional testing if properly documented.
16. Phased Commissioning: Commissioning completed in phases (by floors, for example) due to size of structure or other scheduling issues, to minimize total construction time.
17. Pre-functional Checklists: Lists of items to inspect and elementary component tests to conduct to verify proper installation of equipment, provided by GC/CM to Commissioning Authority who shall review and approve scope of tests. Pre-functional checklists are primarily static inspections and procedures to prepare equipment or system for initial operation (e.g., belt tension, oil levels, labels affixed, gauges in place, sensors calibrated). Some pre-functional checklist items may entail simple testing of function of components, piece of equipment or systems. Pre-functional refers to testing to be accomplished prior to formal functional testing of installed equipment. Pre-functional checklists augment and may be combined with manufacturer’s start-up checklist. GC/CM shall execute checklists.
18. Sampling: Functional Performance Testing of fraction of total number of identical or near identical pieces of equipment. Sampling population is at discretion of commissioning firm, and is subject to modification based upon sampling results (i.e. will be expanded if initial results warrant).

19. Simulated Condition: Condition created for purpose of testing response of system (e.g., blowing hair dryer on space sensor to determine response of variable volume terminal unit).
20. Simulated Signal: Disconnecting sensor and using signal generator to send amperage, resistance or pressure to transducer and control system to simulate sensor value.
21. Start-up: Initial starting or activating of dynamic equipment, including executing pre-functional checklists.
22. Test, Adjust, and Balance: Process of measuring actual flows of air and hydronic systems, adjusting flows to required values, and documenting results.
23. Trending: Monitoring of equipment performance over time, using data logging equipment or building control system.

1.4 QUALITY ASSURANCE

A. Supervision, coordination, and documentation of commissioning process shall be responsibility of Commissioning Provider.

B. Commissioning Provider shall become familiar with Owner's Project Requirements, Basis of Design documentation, project documents, and shall assume responsibility for overall system commissioning effort.

C. Acceptable Commissioning Firms:
1. OCI Associates, Inc., 181 Melody Lane, Ft. Pierce, FL 34905; Tel: 772-465-1165; Fax: 772-466-1134; Website: www.ociassociates.com
2. Johnson, Levinson, Ragan, Davila, Inc., 1450 Centrepark Blvd., Suite 350, West Palm
   a. Beach, FL 33401; Tel: 561-689-2303; Fax: 561-689-2302; Website: www.jlrdinc.com.
3. TLC Engineering, 874 Dixon Blvd., Cocoa, FL 32922; Tel: 321-636-0274; Fax: 321-
   a. 639-8986; Website: www.tlc-eng.com.

1.5 COORDINATION

A. Commissioning Provider will be hired by Owner. Commissioning Provider shall direct and coordinate activities of commissioning team.

B. Commissioning team shall consist of Commissioning Provider, Owner, GC/CM, and associated subcontractors.

C. Scheduling: Commissioning Provider shall schedule commissioning activities of and shall coordinate schedule with GC/CM. Commissioning Provider shall generally provide not less than two (2) weeks notice to GC/CM of commissioning activities, except where retesting is required or commissioning activities have been delayed by no fault of commissioning firm.

1.6 COMMISSIONING PROCESS

A. Commissioning Provider shall develop and coordinate execution of commissioning plan; observe and document installation, check-out, start-up, and equipment and system testing to establish that equipment and systems are functioning in accord with project requirements, and to assist in developing correct and complete documentation of construction effort.

B. Commissioning Provider shall not be responsible for design concept, design criteria, compliance with codes, design, construction scheduling, cost estimating, construction management, or construction supervision.

C. Commissioning Provider may assist design team with problem-solving, or GC/CM with correction of non-conformance items or deficiencies.

D. Commissioning Provider is not responsible for providing tools required to start, check-out and perform functional tests of equipment and systems, except for specified testing with supplemental portable data-loggers, which shall be supplied and installed by Commissioning Provider.

E. Work Required during Construction Phase:

1. Ensure compliance with construction documents, and achieve following objectives:
2. Review the engineer of records basis of design as well as the project design documents and make comments pertaining to the execution of commissioning.
3. Develop commissioning plan and distribute to GC/CM, Owner and Engineer.
4. Coordinate commissioning activities during construction with GC/CM, and ensure that commissioning activities are included in master project schedule.
5. Review submittals applicable to systems being commissioned, including GC/CM proposed detailed start-up procedures, concurrent with Engineer's reviews and provide review comments to Engineer and Owner.
6. Commissioning provider’s review shall be for compliance with commissioning needs, and to aid in development of functional testing procedures and only secondarily to review for compliance with equipment specifications. Design professional remains responsible for interpretation of compliance with contract requirements.
7. Request and review additional information as required to perform assigned commissioning tasks, including review of operations and maintenance materials, and GC/CM’s start-up and check-out procedures.
8. Develop specific Functional Performance Test procedures and forms to document proper operation of equipment and system.
9. Submit proposed functional tests to Engineer for review and general conformance to requirements of contract documents and provide copy of proposed functional performance test procedures to GC/CM who shall review proposed tests for feasibility, safety, equipment and warranty protection.
10. Required performance testing includes control system trending, stand-alone data logger monitoring, or manual logging of system operation to demonstrate proper operation. Functional Performance Test forms shall include following information:
    a. Date.
    b. Project name.
    c. System and equipment or component name(s).
    d. Equipment location and identification number.
    e. Test identification number, and reference to pre-function checklist and start-up documentation identification numbers for each piece of equipment.
    f. Participating parties.
    g. Reference to specification describing specific sequence of operations or parameters being tested or verified.
    h. Formulae used in calculations.
    i. Required pre-test field measurements.
    j. Instructions for setting up test.
    k. Special cautions or alarm limits.
    l. Specific step-by-step procedures to execute test, in clear, sequential, and repeatable format.
    m. Acceptance criteria of proper performance with provisions for clearly indicating whether or not proper performance of each part of test was achieved.
    n. Section for comments.
    o. Signature and date block for Commissioning Provider and participating parties.
11. Review GC/CM start-up and pre-functional testing reports and provide on-site observation of start-up and pre-functional testing as specified herein.
12. Review proposed testing, adjusting, and balancing execution plan for completeness and requirements of commissioning process and provide comments to GC/CM, Engineer, and Owner.
13. Perform site visits, monthly until pre-functional testing of equipment and systems begins, and then weekly throughout Project, to review component and system installations. Concurrently, schedule and conduct commissioning planning and coordination meetings

to review construction progress and to assist in resolving discrepancies or issues relating to commissioning process.

F. Acceptance Phase: demonstrate that performance of equipment and systems installed during construction phase meets requirements of construction documents. Notify Owner and Engineer of deficiencies in results or procedures. Commissioning activity shall achieve following objectives:
   1. Coordinate, witness, and approve functional tests of equipment and systems performed by GC/CM. Review functional test reports and analyze trend logs, data logger reports, and other monitoring data to evaluate equipment and system performance.
   2. Document performance of functional testing and provide comparison to required performance, as defined by project documents.
   3. Coordinate retesting as necessary until satisfactory performance is demonstrated.
   4. Maintain master deficiency and resolution log, separate testing record log, and provide written progress reports and test results with recommended corrective actions for observed deficiencies.
   5. Compile and submit commissioning report to Owner and Engineer documenting results of the Start-Up, Pre-Functional Performance Testing, and Functional Performance Testing.
   6. Review GC/CM's proposed training of Owner's operating personnel, and provide comments to Engineer and Owner.
   7. Coordinate and attend GC/CM provided training sessions. Verify approved training has been properly completed.

G. Warranty period: assist Owner in identifying defects in installed equipment or system operation to accomplish following objectives:
   1. Review equipment warranties to ensure that Owner's responsibilities are clearly defined.
   2. Verify that warranty items have been corrected properly.
   3. Coordinate and supervise required seasonal or deferred testing and deficiency corrections, as specified or required by commissioning plan.
   4. Return to site, approximately 10 months into warranty period and review with Owner building operation and condition of outstanding issues related to original and seasonal commissioning.
   5. Assist Owner in reviewing failure and repair records of equipment during warranty period and in evaluation of GC/CM's corrective actions. Identify areas that may come under warranty or under original construction contract.
   6. Interview Owner and identify problems or concerns regarding operating building as originally intended and shall make suggestions for improvements.
   7. Assist the Owner in developing reports, documents, and requests for services to remedy outstanding problems.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 REPORTING

A. Provide final commissioning report to Owner with following reports:
   1. Copies of periodic commissioning reports.
   2. Copies of Pre-Functional Performance Test reports.
   3. Copies of Functional Performance Test reports.
   4. Copies of the Training Report.

3.2 SYSTEMS TO BE COMMISSIONED

A. As defined previously herein under item 1.1, F.

3.3 START-UP, PREFUNCTIONAL CHECKLISTS, AND INITIAL CHECK-OUT

A. GC/CM shall be responsible for initial check-out and pre-functional testing of installed equipment and systems.

B. Commissioning Provider shall monitor activities of parties responsible for executing required start-up, and pre-functional testing, as identified in commissioning plan.

C. Commissioning Provider shall review GC/CM furnished documentation of start-up, initial check-out, and pre-functional test procedures for equipment and systems to ensure that there is written documentation that each manufacturer-recommended procedures has been completed.

D. Observe first pre-functional test procedures for each type and size equipment to ensure that approved procedures are being followed.
   1. For lower-level components of equipment, (e.g., variable volume terminal units, sensors, controllers), observe sampling of pre-functional and start-up procedures.
   2. In no case, shall number of units witnessed be less than 20% of total number of identical or very similar units.

3.4 FUNCTIONAL PERFORMANCE TESTING

A. Functional Performance Testing of equipment or systems shall be conducted only after pre-functional testing and start-up has been satisfactorily completed. Schedule functional tests with GC/CM. Direct, witness, and document Functional Performance Testing of equipment and systems to be commissioned. GC/CM shall be responsible for execution of Functional Performance Tests.

B. Functional Performance Testing shall demonstrate that each item of equipment and each system is operating according to requirements of construction documents as defined by A/E. Each item of equipment and system undergoing Functional Performance Testing shall be operated through all modes of operation where there is required system response. Verify each action required in sequences of operation has been accomplished according to requirements, or A/E shall revise sequences as deemed appropriate.

C. Functional Performance Testing shall proceed from components to subsystems to systems. When proper performance of interacting individual systems has been achieved, interface or coordinated responses between systems shall be tested.

D. Proper and accurate operation of control system shall be proven by functional testing and approved by Commissioning Provider before it may be used for testing, adjusting and balancing activities or to verify performance of other components or systems. If authorized by Commissioning Provider, portions of control system may be tested and approved before functional testing of the entire system is completed.

E. Air and water balancing shall be completed and corrected as necessary before Functional Performance Testing of air-related or water-related equipment or systems.

F. Test Methods:
   1. Functional Performance Testing and verification shall be achieved by manual testing (direct manipulation of equipment and observation of its response and performance) or by monitoring performance using control system’s trend log capabilities.
   2. Functional Performance Test procedures shall specify which methods shall be used for each test. Determine which method is most appropriate for tests that do not have method specified.
   3. Commissioning Provider may substitute specified methods or require additional method to be executed, other than that specified, if required to demonstrate proper operation of equipment or system being tested.
   4. Develop Functional Performance Testing plans that define allowable sampling procedures and that specify procedures to be followed in case of observed discrepancies or failures in sample chosen for functional testing.

5. AHU operation (leaving air temperature, VFD speed) shall be trend logged with VAV box and air valve flow rates, as well as space temperatures to demonstrate modulation of system components with changing loads, as well as occupied/non-occupied status and control strategies such as optimum static pressure reset and temperature set-up/set-back.
6. Sampling: multiple identical pieces of non-life-safety or otherwise non-critical equipment may be functionally tested using sampling strategy, as defined in functional test procedures.
    a. Significant application differences and significant sequence of operation differences in otherwise identical equipment invalidates their common identity.
    b. Small size or capacity difference, alone, does not constitute difference.
    c. The following equipment may be sample tested: reheat coils, terminal boxes, occupancy sensors, and lighting controls.
7. If 10% or 3 or more identical pieces of equipment (size alone does not constitute a difference) fail to perform to requirements of project documents (mechanically or substantively) due to manufacturing defects or application error not allowing it to meet performance specifications, identical units may be considered unacceptable by Commissioning Provider. In such case, GC/CM shall provide Commissioning Provider with the following:
    a. Within 1 week of notification from Commissioning Provider, GC/CM or manufacturer's representative shall examine other identical units making record of findings. Findings shall be provided to Commissioning Provider within 2 weeks of original notice.
    b. Within 2 weeks of original notification, GC/CM shall provide signed and dated, written explanation of problem, cause of failures, and proposed solution, including full equipment submittals for corrective or replacement equipment, if appropriate. Proposed solutions shall meet requirements of original installation.
    c. Commissioning Provider shall evaluate proposed solution and submit recommendation of approval or disapproval to Owner and Engineer.
    d. When approved, 2 examples of proposed solution shall be installed by GC/CM and Commissioning Provider shall schedule and conduct functional testing of proposed solution. Upon completion of functional testing of proposed solution, Commissioning Provider shall recommend acceptance or disapproval of proposed solution to Owner.
    e. Upon acceptance of proposed solution by Owner, GC/CM shall replace or repair identical items and extend warranty accordingly, if original equipment warranty had begun. Replacement/repair work shall proceed with reasonable speed beginning within 2 weeks of approval of proposed solution.
8. Ensure that each Functional Performance Test is performed under conditions that simulate actual operating conditions as closely as is practically possible.
9. Simulation of operating conditions (not by overwritten value) may be allowed, at Commissioning Provider's discretion. Simulation of conditions shall be accomplished by subjecting the equipment to actual operating conditions by artificial means whenever possible.
10. Where actually achieving simulated operating condition is impractical, as determined by Commissioning Provider or as identified in Functional Performance Test procedure, use of signal generators to create simulated signal may be used to test and calibrate transducers and DDC constants instead of using sensor to act as signal generator via simulated conditions or overwritten values. Signal generators or simulators shall be provided by GC/CM.
11. Overwriting sensor values to simulate conditions, such as overwriting outside air temperature reading in control system to be different than it really is, may be allowed if approved by Commissioning Provider. Simulation of operating conditions is preferable.
12. Altering setpoints: rather than overwriting sensor values, and when simulating conditions is difficult, altering setpoints shall be used to test sequences.

13. Indirect indicators: relying on indirect indicators for responses or performance may be allowed only after the Commissioning Provider has visually and directly verified that indirect readings represent actual conditions and responses over range of test parameters.

3.5 RETESTING OF EQUIPMENT AND/OR SYSTEMS

A. Prior to retesting of functional performance tests found to be deficient, submit data indicating that deficient items have been completed and corrected to Commissioning Provider.

B. After review of submitted data, if corrective measures are acceptable, Commissioning Provider shall schedule and conduct recheck.

C. If during retesting it becomes apparent that deficient items have not been completed and corrected as indicated in data provided by GC/CM, retesting shall be stopped. Costs for commissioning team to further supervise retesting of Functional Performance Test shall be the responsibility of GC/CM.

3.6 DOCUMENTATION, NONCONFORMANCE, AND APPROVAL OF TESTS

A. Documentation: Witness and document results of functional tests using specific procedural forms developed for that purpose. Deficiencies or nonconformance issues shall be noted and reported with test results. Include completed test forms in final commissioning report.

B. As Functional Performance Testing progresses and deficiencies are identified, discuss issues and attempt to resolve discrepancies with GC/CM.

C. Approval: Note each satisfactorily demonstrated function on functional test form. Formal approval of functional tests shall be made after review of test reports by Commissioning Provider and Owner. Recommend acceptance of each test to the Owner using standard form. Owner shall give final approval on each test using same form, providing signed copy to Commissioning Provider and GC/CM.

3.7 DEFERRED TESTING

A. Deferred testing: if required pre-functional or functional test cannot be completed as scheduled, execution of checklists and functional testing may be delayed upon approval of Commissioning Provider and Owner. Deferred tests shall be conducted in same manner as seasonal tests as soon as possible.

B. Schedule and coordinate any required seasonal testing, tests delayed until weather or other conditions are suitable for demonstration of equipment or system’s performance. Seasonal testing shall be executed, documented, and deficiencies corrected as specified herein for functional testing. Adjustments or corrections to operations and maintenance manuals and record documents due to test results of shall be made before seasonal testing process is considered complete. Schedule deferred testing with GC/CM and Owner.

3.8 OPERATION AND MAINTENANCE MANUALS

A. Prior to beginning specified training programs, review draft operations and maintenance manuals, equipment documentation, and as-installed drawings for systems that were commissioned and verify compliance with documents. Communicate deficiencies in documents to Owner and Contractor. When identified deficiencies have been corrected, recommend approval and acceptance of operations and maintenance manuals to Owner. Review equipment warranties and verify that requirements needed to keep warranty valid are clearly identified.

B. Ensure that Owner's Project Requirements, basis of design, are included in the first section of operations and maintenance manuals. Narrative sections shall be updated by responsible parties to record status.

END OF SECTION

SECTION 02 41 00 - DEMOLITION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Building demolition excluding removal of hazardous materials and toxic substances.

B. Disconnecting, capping, or sealing, and abandoning in-place and/or removing site utilities.

C. Selective demolition of built site elements.

D. Selective demolition of building elements for alteration purposes.

E. Abandonment and removal of existing utilities and utility structures.

F. Salvage of existing items to be reused or recycled.

1.3 REFERENCE STANDARDS

A. 29 CFR 1926 - Safety and Health Regulations for Construction; Current Edition.

B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2027.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 DEFINITIONS

A. Refer to Section 01 42 16 – Definitions, for the following terms:
   1. Demolish.
   2. Remove.
   3. Remove and Salvage.
   4. Remove and Reinstall.
   5. Existing to Remain.

1.6 SUBMITTALS

A. Refer to Section 01 30 00.0 - Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 – Product Requirements for sustitution procedures.

C. Qualification Data: For refrigerant recovery technician.

D. Engineering Survey: Submit engineering survey of condition of building.

E. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.

F. Schedule of Selective Demolition Activities: Indicate the following:
   1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's building manager's on-site operations are uninterrupted.
   2. Interruption of utility services. Indicate how long utility services will be interrupted.
   3. Coordination for shutoff, capping, and continuation of utility services.
   4. Use of elevator and stairs.
   5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

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G. Pre-demolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces that might be misconstrued as damage caused by demolition operations.

H. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

I. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

J. Site Plan: Indicate:
   1. Vegetation to be protected.
   2. Areas for temporary construction and field offices.
   3. Areas for temporary and permanent placement of removed materials.

K. Demolition Plan: Submit demolition plan as required by OSHA and local AHJs.
   1. Indicate extent of demolition, removal sequencing, bracing and shoring, and location and construction of barricades and fences.
   2. Summary of safety procedures.
   3. Demolition firm qualifications.

L. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.7 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Company specializing in performing the Work of this Section with minimum five years documented experience.

B. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

C. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.8 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ASSE A10.6 and NFPA 241.

C. Conform to applicable codes for demolition of structures, safety of adjacent structures, dust control, runoff, and erosion control, and disposal of demolished materials.

D. Obtain required permits from authorities having jurisdiction.

E. Notify affected utility companies before starting work and comply with their requirements.

F. Do not close or obstruct roadways, sidewalks, and hydrants, without permits.

G. Conform to applicable regulatory procedures when discovering hazardous or contaminated materials and contact the Architect and Owner immediately if discovered.

H. Test soils around buried tanks for contamination.

I. No demolition will occur during occupied hours without the permission of the Owner.

J. Comply with the requirements of the FFPC - Florida Fire Prevention Code, NFPA 1 – Chapter 16 and NFPA 241 Standard for Safeguarding Construction, Alteration, and Demolition Operations.

1.9 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

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C. Notify Architect of discrepancies between existing conditions and drawings before proceeding with selective demolition.

D. Storage or sale of removed items or materials on-site is not permitted.

E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

F. Maintain fire-protection facilities in service during selective demolition operations.

G. Arrange selective demolition schedule so as not to interfere with Owner's operations.

1.10 HAZARDOUS MATERIALS

A. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner.

B. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
   1. Hazardous materials will be removed by Owner before start of the Work.
   2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

C. Hazardous Materials: Present in buildings and structures to be selectively demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.
   1. Hazardous material remediation is specified elsewhere in the Contract Documents.
   2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
   3. Owner will provide material safety data sheets for suspected hazardous materials that are known to be present in buildings and structures to be selectively demolished because of building operations or processes performed there.

1.11 SALVAGE

A. The Owner has the first right to salvage reusable equipment.

B. The Contractor shall salvage indicating items for reuse in the project.
   1. Carefully salvage indicated items in a manner to prevent damage and promptly return to Owner where indicated.

C. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations. Comply with specification section "Photographic Documentation."

D. Salvage: Items indicated to be removed for salvaged:
   1. Clean salvaged items of dirt and demolition debris.
   2. Store items in a secure area until delivery to Owner.
   3. Protect items from damage during transport and storage.

1.12 PRE-DEMOLITION MEETING

A. The Contractor shall conduct a pre-demolition meeting at the project site a minimum of 30 days prior to any work being installed as indicated in this section and other related sections that require coordination with this section.
   1. Inspect and discuss condition of construction to be selectively demolished.
   2. Review and finalize protection requirements.
   3. Review items to be salvaged and returned to Owner.

1.13 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of capped utilities, subsurface obstructions, and structures.

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1.14 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor before proceeding.

B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 DEMOLITION

A. Remove the entire building as designated on the Drawings.

B. Remove portions of existing building as designated on the Drawings.

C. Remove paving and curbs required to accomplish new work.

D. Remove all other paving and curbs within site boundaries.

E. Break up paving within site boundaries to permit natural moisture drainage; leave pieces not larger than 1 square yard (1 square meter).

F. Within area of new construction, remove foundation walls and footings to minimum 2 feet (600 mm) below finished grade.

G. Outside area of new construction, remove foundation walls and footings to minimum 2 feet (600 mm) below finished grade.

H. Remove concrete slabs on grade within site boundaries.

I. Break up concrete slabs on grade within site boundaries to permit natural moisture drainage; leave pieces not larger than 1 square yard (1 square meter).

J. Remove other items indicated, for salvage and relocation.

K. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as specified in Section 31 22 00.

3.2 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Engage a professional engineer to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
   1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

D. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

E. Salvaged Items: Provide photographs or video of equipment to be salvaged prior to commencing work and conditions that might be misconstrued as damage caused by salvage operations.

3.3 CLARIFICATION

A. The drawings do not purport to show all objects existing on the site.

B. Before commencing the work of this section, verify with the architect all objects to be removed and all objects to be preserved.

3.4 SCHEDULING

A. Schedule all work in a careful manner with all necessary consideration for the public and the Owner.

B. Avoid interference with the use of, and passage to and from, adjacent facilities.

3.5 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Obtain required permits.
   2. Comply with applicable requirements of NFPA 241.
   3. Use of explosives is not permitted.
   4. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
   5. Provide, erect, and maintain temporary barriers and security devices.
   6. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
   7. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
   8. Do not close or obstruct roadways or sidewalks without permits from authority having jurisdiction.
   9. Conduct operations to minimize obstruction of public and private entrances and exits. Do not obstruct required exits at any time. Protect persons using entrances and exits from removal operations.
   10. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon, or limit access to their property.

B. Do not begin removal until receipt of notification to proceed from Owner.

C. Do not begin removal until built elements to be salvaged or relocated have been removed.

D. Do not begin removal until vegetation to be relocated has been removed and vegetation to remain has been protected from damage.

E. Protect existing structures and other elements to remain in place and not removed.
   1. Provide bracing and shoring.
   2. Prevent movement or settlement of adjacent structures.
   3. Stop work immediately if adjacent structures appear to be in danger.

F. Minimize production of dust due to demolition operations. Do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

G. Hazardous Materials:
   1. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCBs, and mercury.
   2. Hazardous Materials: Comply with 29 CFR 1926 and state and local regulations.

H. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

3.6 EXISTING UTILITIES

A. Coordinate work with utility companies. Notify utilities before starting work, comply with their requirements, and obtain required permits.

B. Protect existing utilities to remain from damage.

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C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.

E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.

F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

H. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone. Identify and mark, in same manner as other utilities to remain, utilities to be reconnected.

3.7 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Existing construction and utilities indicated on drawings are based on casual field observation and existing record documents only.
   1. Verify construction and utility arrangements are as indicated.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Separate areas in which demolition is being conducted from areas that remain occupied.
   1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 50 00 in locations indicated on drawings.
   2. Provide sound retardant partitions of construction and in locations indicated on drawings.

C. Maintain weatherproof exterior building enclosure, except for interruptions required for replacement or modifications; prevent water and humidity damage.

D. Remove existing work as indicated and required to accomplish new work.
   1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction indicated.
   2. Remove items indicated on drawings.

E. Services including, but not limited to, HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications: Remove existing systems and equipment as indicated.
   1. Maintain existing active systems to remain in operation, and maintain access to equipment and operational components.
   2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
   3. Verify that abandoned services serve only abandoned facilities before removal.
   4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings. Remove back to source of supply where possible, otherwise cap stub and tag with identification.

F. Protect existing work to remain.
   1. Prevent movement of structure. Provide shoring and bracing as required.
   2. Perform cutting to accomplish removal work neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.
   4. Patch to match new work.

3.8 PREPARATION

A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

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3.9 GENERAL

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
   1. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
   1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
   2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
   3. For Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
   4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.
   5. Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other sections of these specifications.
   1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
   2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
   3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
      a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
   4. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.
   5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weather tight condition.

3.10 PREPARATION

A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.11 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished. Refer to engineering drawings for further information.
   1. Contractor to arrange to shut off utilities with utility companies.

2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on drawings to be removed.
4. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
5. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
6. Equipment to Be Removed: Disconnect and cap services and remove equipment.
7. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
8. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
9. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.

3.12 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
   1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
   2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
   3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.

B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
   1. Strengthen or add new supports when required during progress of selective demolition.

C. Remove temporary barricades and protections where hazards no longer exist.

D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.13 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
   1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
   2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
   3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.

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4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
5. Maintain fire watch during and for at least 24 hours after flame-cutting operations.
6. Maintain adequate ventilation when using cutting torches.
7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
10. Dispose of demolished items and materials promptly.

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

3.14 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.

C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.

D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.

E. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.

F. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight.
1. Remove existing roof membrane, flashings, copings, and roof accessories.
2. Remove existing roofing system down to substrate.

3.15 DEBRIS AND WASTE REMOVAL

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
4. Comply with requirements specified in specification section “Construction Waste Management and Disposal.”

B. Leave site in clean condition, ready for subsequent work.

C. Clean up spillage and wind-blown debris from public and private lands.

D. Burning: Do not burn demolished materials.

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3.16 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION

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SECTION 03 00 00 - CONCRETE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Work of this section shall conform to the requirements of the Contract Documents, including the General Conditions, Supplementary General Conditions, Special Conditions, and Division 1 General Requirements.

1.02 DESCRIPTION

A. Work Included: The extent of the concrete work is indicated on drawings and specified herein. Concrete Work includes, but is not limited to, the following:

1. Cast-in-place stone concrete.
2. Reinforcing steel.
3. Concrete admixtures.
4. Formwork.
5. Curing of concrete.
6. Finishing of concrete.
7. Protection of concrete.
8. Plastic waterstops.
9. Expansion Joint Fillers.

1.03 QUALITY ASSURANCE

A. Codes and Standards: Comply with the provisions of the following codes, specifications and standards, except where more stringent requirements are shown or specified:

1. ACI 301 "Specifications for Structural Concrete for Buildings".
2. ACI 318 "Building Code Requirements for Reinforced Concrete".
3. Concrete Reinforcing Steel Institute, "Manual of Standard Practice".

B. For any item not specifically covered in these specifications, ACI 301-81 "Structural Concrete for Buildings" will govern.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's product data with applications and installation instruction for materials and items, including but not limited to, reinforcement and forming accessories, admixtures, waterstops, and others as requested.

B. Shop Drawings: Reinforcement - Submit shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" and as shown on the drawings, showing bar schedules, stirrup spacing, diagrams of bent bars, arrangement of concrete reinforcement. Include special reinforcement if required.

1. All reinforcing steel is to be precut off-site in an approved fabricating shop by an approved Subcontractor for reinforcing steel fabrication.

C. Laboratory Test Reports: Submit laboratory test reports for mix designs as specified.

D. Mix Design: This Contractor shall submit a mix design for each type of concrete required for approval by the Engineer. Refer to Part 4 of this Section for additional requirements.

E. Material Certificates: Submit certificates for reinforcing steel as hereinafter specified.

F. Admixture(s) Certification(s): Submit certifications(s) as hereinafter specified.

1.05 JOB CONDITIONS

A. Time of Completion and Procedure of Construction: Time of Completion is a matter of utmost importance in connection with this Contract. By the submission of a bid, this Contractor agrees to diligently perform his work so as to assure completion within the time limits and Pre-Bid CPM Schedule.

PART 2 - PRODUCTS

2.01 FORM MATERIALS

A. Forms for Concrete: Construct all formwork for concrete surfaces with plywood, lumber, or metal. Provide lumber dressed on at least two (2) edges and one (1) side for tight fit. Provide form material with sufficient thickness to withstand pressure of newly-placed concrete without objectionable bow or deflection.

B. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.

2.02 REINFORCING MATERIALS

A. Reinforcing Bars: Reinforcing steel must be correctly rolled to section and free from all surface defects and shall be in accordance with ASTM A-615, Grade 60, as evidenced by manufacturer's certificates. The grade of steel shall be intermediate, new billet stock. All bars shall be deformed and rolled with raised symbols to identify the manufacturer and the size of the bar.

B. Tie wire shall be No. 18 U.S. Steel wire gauge black annealed wire.

C. Supports for Reinforcement: Spacerbars, slab bolsters, chairs, wiring, nails, and other accessories shall be standard commercial metal supports and plastic where exposed to weather or where rust will impair architectural finish.

2.03 CONCRETE MATERIALS

A. Portland Cement: ASTM C-150, Type 1.

B. Supplementary Cementitious Materials:

1. Fly Ash: ASTM C618, Type F may be used up to a maximum of 25% of the total cementitious content.

2. Ground Granulated Blast-Furnace Slag: ASTM C989, Grade 100 or 120 may be used up to a maximum of 40% of the total cementitious content.

3. The exact percentages used shall be based on a successful test placement on-site.

C. Fine Aggregate: Clean, natural siliceous sand, consisting of hard, strong, durable, uncoated particles, and shall conform to the requirements of ASTM C-33.

D. Coarse Aggregate: Clean, hard, uncoated, strong, durable gravel, or crushed stone, and shall conform to the requirements of ASTM C-33. The maximum size of coarse aggregate shall be 1 inch.

E. Water: Potable for mixing and curing concrete and shall not contain amounts of impurities injurious to the concrete.

F. Light Weight Aggregate: Conform to ASTM C-330.

2.04 ADMIXTURES

A. General: No admixtures shall be used in concrete unless otherwise specified herein and except with the permission of the Structural Engineer and after laboratory design mix approval. This Contractor shall provide the services of the admixture manufacturer's representative to assure proper use of admixtures if required.

1. Prohibited Admixtures: Calcium chloride, thicoyanates containing more than 0.05% chloride ions are not permitted. Admixtures containing more than 0.05% chloride ions are not permitted.

2. Certification: Written conformance to the above mentioned requirements and the chloride ion content of the admixture will be required from the admixture manufacturer prior to mix design review by the Engineer.

B. Water Reducing Admixture: Conform to ASTM C-494, Type A. Provide one of the following products:

1. W.R. Grace & Co. - "WRDA with Hycol"

2. Master Builders - "Pozzolith 322N"

3. The Euclid Chemical Company - "Eucon WR-75"

4. Sika Chemical Corp - "Plastocrete 161"

C. Accelerating Admixture: Non-chloride, non-corrosive and conform to ASTM C-494, Type C & E.

1. The Euclid Chemical Co. - "Accelguard 80"

2. W.R. Grace & Co. - "Daraset"

3. Master Builders - "Pozzolith 500A"

D. Air Entraining Admixture: The air-entraining admixture shall conform to ASTM C-260 and shall be used where necessary to achieve the specified air content.

E. Water Reducing Retarder Admixture: Conform to ASTM C-494, Type D.

1. The Euclid Chemical Co. - "Eucon Retarder-75"

2. W.R. Grace & Co. - "Daratard-17"

3. Sika Chemical Corp - "Plastocrete 161-R"

4. Master Builders - "Pozzolith 100-XR"

F. High Range Water Reducing Admixture: Conform to ASTM C-494, Type F. These admixtures shall be used in strict accordance with the manufacturer's recommendations. Provide one of the following products:

1. W.R. Grace & Co. - "Daracem - 100"

2. Sika Chemical Corp - "Sikament"

3. The Euclid Chemical Co - "Eucon-37"

4. Master Builders - "Rheobuild 716"

2.05 RELATED MATERIALS

A. Anchor Bolts: Anchor bolts shall be ASTM A-307. For size and length of anchor bolts refer to the Structural drawings.

B. Joint Fillers: Expansion joint fillers shall be asphalt impregnated fiberboard conforming to ASTM D-1751. Joint fillers shall extend full depth of joint and be of thickness indicated on drawings.

C. Waterstops: Provide flat, dumbbell type or center bulb type waterstops at construction joints and other joints as shown. Size to suit joints.

D. Non-Shrink Grout: Pre-mixed non-shrink grout as called for on drawings shall be as manufactured by:

1. The Euclid Chemical Co. - "Euco N-S Grout" (All exposed grout).

2. The Euclid Chemical Co. - "Firmix"

3. Master Builders - "Masterflow 713 Grout"

4. U.S. Grout Corporation - "Five Star Grout"

5. Lambert Corp. - "Vibropruf #11"

E. Curing Compounds: Curing compounds shall be manufactured by:

1. "Super Floor Coat" or "Super Rez Seal" by the Euclid Chemical Company, "Masterseal" by Master Builders, or approved equal, for curing and sealing all garage, exterior exposed, and mechanical room floors. The compound shall be a clear styrene acrylate type, 30% solids content minimum moisture loss of 0.030 grams per sq. cm. when applied at a coverage rate of 300 sq. ft. per gallon. Manufacturer's certifications required.

2. Other interior slabs shall be cured with the dissipating resin type compound, "Kurez DR VOX" , or “kurez DR-100” by The Euclid Chemical Company or approved equal. The compound shall conform to ASTM 309 and chemically break down in a two to four-week period. The curing compounds must be applied immediately after finishing and on formed surfaces following form removal.

F. Plastic Reglets: Provide "Type A" prefilled P.V.C. reglets where indicated, made by Superior Concrete Accessories, Inc. Install in strict accordance with manufacturer's details and directions.

G. Bonding Compound: The compound shall be polyvinyl acetate, rewetable type, "Euco Weld" by The Euclid Chemical Company or "Weldcrete" by The Larsen Company.

H. Epoxy Adhesive: The compound shall be a two (2) component, 100% solids, 100% reactive compound suitable for use on dry or damp surfaces, "Euco Epoxy #463 or #615 " by The Euclid Chemical Company or "Sikadur Hi-Mod by Sika Chemical Corporation.

1. Polyvinyl chloride (PVC) waterstops: Corps of Engineers CRD-C 572.

2.06 CONCRETE PROPORTIONS

A. All mix designs shall be proportioned in accordance with Section 4.3, "Proportioning on the Basis of Field Experience and/or Trial Mixtures" of ACI 318-83. Submit mix designs on each class of concrete for review. If trial batches are used, the mix design shall be prepared by an independent testing laboratory and shall achieve a compressive strength 1200 psi higher than the specified strength. This over-design shall be increased to 1400 psi when concrete strengths over 5000 psi are used. All proposed mixes shall be submitted for approval prior to the start of concrete operations.

B. Cement, aggregate and other materials required for design or verification mixes by the laboratory shall be supplied by this Contractor.

C. Measurements of fine and coarse aggregate shall be made separately by weight. The proportioning of aggregate for fractional sacks of cement will not be permitted unless the cement is weighed for each batch. Weighing equipment shall be arranged to permit making compensation for changes in the weight of moisture contained in the aggregate.

D. Batching equipment shall be subject to inspection and approval.

E. Design Mixes to provide normal weight concrete with the following properties, as indicated below, unless otherwise indicated on drawings and schedules.

1. Self-Consolidating Concrete: Use where indicated on the plans. Minimum flow of 20" or as required by the successful test placement. All self-consolidating concrete shall contain the specified high-range water-reducing admixture and viscosity-modifying admixture as required. Required workability, pumpability, surface finish, and setting time must be verified with a successful test placement onsite.

2. "Quick Dry" Concrete: Maximum W/cm – 0.40, superplasticized, 3% maximum air content. The floor finish shall be as required by the manufacturer of the specified floor coating or covering.

F. Water-Cement Ratio: Design mixes to provide normal weight concrete with the following properties, as indicated on drawings and schedules:

5000-psi, 28-day compressive strength; W/C ratio, 0.42 maximum (non-air-entrained), 0.32 maximum (air-entrained).

4000-psi, 28-day compressive strength; W/C ratio, 0.45 maximum (non-air-entrained), 0.35 maximum (air-entrained).

3500-psi, 28-day compressive strength; W/C ratio, 0.48 maximum (non-air-entrained), 0.40 maximum (air-entrained). Use for all steel troweled interior slabs subject to vehicular traffic. Include structural fibers in all loading dock slabs and toppings at the rate of 5 lbs. per cubic yard

3000-psi, 28-day compressive strength; W/C ratio, 0.52 maximum (non-air-entrained), 0.46 maximum (air-entrained).

2500-psi, 28-day compressive strength; W/C ratio, 0.54 maximum (non-air-entrained), 0.50 maximum (air-entrained).

G. Lightweight Concrete - Proportion mix as specified. Design mix to produce strength and modulus of elasticity as noted on drawings, with a splitting tensile strength factor (Fct) of not less than 5.5 for 3000-psi concrete and a dry weight of not less than 95 lbs. or more than 110 lbs. after 28 days. Limit shrinkage to 0.03 percent at 28 days.

H. Admixtures

1. Use water-reducing admixture or high range water-reducing admixture (super plasticizer) in all concrete.

2. Use accelerating admixture in concrete slabs placed at ambient temperatures below 50 deg. F. (10 deg. C.).

3. Use air-entraining admixture in exterior exposed concrete unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point if placement having air content within following limits:

   a. Concrete structures and slabs exposed to freezing and thawing or subjected to hydraulic pressure:

   b. 3% to 5% for maximum 1" aggregate.

4. Use admixtures for water-reducing and set-control in strict compliance with manufacturer's directions.

I. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement of 4 inches plus or minus 1 inch. Concrete containing HRWR admixture (superplasticizer): Not more than 8 inches.

2.07 MIXING

A. Job Site Mixing: Mix materials for concrete in appropriate drum type batch machine mixer. For mixers of one cu. yd., or smaller capacity, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released. For mixers of capacity larger than one cu. yd., increase minimum 1-1/2 minutes of mixing time by 15 seconds for each additional cu. yd., or fraction thereof.

1. Provide batch ticket for each discharged and used in work, indicating project identifications name and number, date, mix type, mix time, quantity, and amount of water introduced.

B. Ready-Mix Concrete: Comply with requirements of ASTM C- 94, and as herein specified.

1. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C-94 shall be required. When air temperature is between 85°F (30°C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90°F (32°C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.01 FORMS

A. Forms shall be so constructed that the finished concrete will conform to the shapes, lines, and dimensions shown on the Contract drawings. They shall be substantially built and sufficiently tight to prevent leakage of water or paste and securely braced in order to maintain their true position and shape. If any form loses its proper shape or position, it shall immediately be repaired to the satisfaction of the Architect or removed and replaced with a new form. Provide cleanout openings.

B. Earthcuts shall not be used as forms for vertical surfaces.

C. The design and engineering of the formwork, as well as its construction, shall be the sole responsibility of this Contractor.

1. Formwork design, tolerances of finished lines, and camber to compensate for deflections due to weight of concrete shall conform to "Recommended Practice for Concrete Formwork (ACI-347)", or as otherwise noted.

D. Form Ties

1. Factory-fabricated, adjustable length, removable, or snap off metal form ties designed to prevent deflection and to prevent spalling concrete surfaces upon removal.

a. Provide ties so that portion remaining within concrete after removal of exterior parts is at least 1-1/2 inches from the outer concrete surfaces.

E. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such items. Accurately place and securely support items built into forms.

F. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, woods, sawdust, dirt or other debris just before concrete is placed. Retighten forms and bracing after concrete placement is required to eliminate mortar leaks and maintain proper alignment.

3.02 PLACING REINFORCEMENT

A. Reinforcement fabricated to the shapes and dimensions shown or required shall be placed where indicated on the Contract Documents.

B. Before any reinforcement is placed, any loose rust of mill scale or coatings, including ice or oil, which would reduce or destroy the bond, shall be removed. Reinforcement materially reduced in section shall not be used.

C. Concrete cover over steel reinforcement shall be as shown on the drawings.

D. Bar reinforcement shall be carefully formed to the shapes shown and required to resist most effectively the stresses involved. Bars with kinks or bends not required shall not be used. The reinforcing shall not be bent or straightened in a manner which would injure the material. The heating or reinforcement for bending or straightening will not be permitted.

E. Bends or hooks, unless otherwise shown or required, shall be cold formed around pins. Hooks shall be ACI Standard.

F. Reinforcement shall be wired securely at intersections and shall be held in place with approved bars, spacers, chairs, high chairs, bolsters, or other supports so that it will not be dislocated or otherwise disturbed during the depositing of concrete.

G. Steel reinforcement shall not be spliced at points of maximum stress. Laps in adjacent bars shall be staggered. Laps shall be tied and seized tight at both ends.

H. All dowels shall be secured and tied in place before pouring concrete.

I. Reinforcing steel shall be stored under cover and protected from rusting, oil, grease, or distortion.

3.03 CONSTRUCTION JOINTS

A. Where indicated, construction joints shall be of the types and at the locations indicated on the drawings and specified hereinafter. All other construction joints shall be submitted to the Structural Engineer for approval.

B. Construction joints shall be provided with adequate shear keys for succeeding placements and reinforcement shall be continuous through such joints. No bars shall be continuous through two construction joints.

C. The Contractor shall have means at hand to bring any grade beam placement to an emergency construction joint provided with the proper shear key and/or dowels if an interruption in the supply of concrete or inclement weather makes such a procedure necessary.

D. Waterstops as specified shall be provided at all construction joints in concrete work in elevator pit walls, piping pits, and where indicated on drawings.

E. No horizontal joints will be permitted in walls and grade beams except as shown in the drawings.

F. Unless otherwise noted, the maximum spacing of construction joints should be as follows:

1. Foundation walls and grade beams - forty (40) feet.

3.04 INSTALLATION OF EMBEDDED ITEMS

A. Provide anchor bolts for steel column template at correct elevations as shown on the drawings.

B. Anchor bolts shall be set in location in plan and shall not exceed tolerances specified in AISC "Specifications for Design, Fabrication, and Erection of Structural Steel for Buildings", including the "Commentary" and Supplements thereto as issued.

3.05 CONVEYING AND PLACING

A. Concrete shall be conveyed from the mixer to the forms as quickly as possible by a method which will prevent segregation and loss of materials.

B. Delivery carts and/or buggies where used shall be kept on temporary runways built over the construction, and runway supports shall not bear upon reinforcing steel or fresh concrete.

C. Belt conveyors, chutes or similar equipment will be permitted.

D. Concrete shall not be placed on loose fill, mud or standing water.

E. Concrete shall be deposited continuously. Deposit concrete as nearly as practicable to its final location to avoid segregation.

F. Concrete shall not be incorporated in the work after it has attained its initial set not in any event more than one hour after water has been added to the aggregate.
This period may be reduced at the option of the Joint Venture if it develops that presetting is taking place, particularly in hot weather.

G. Concrete shall be deposited in the forms as nearly as practicable in its final position to avoid rehandling. Special care shall be exercised to prevent splashing of forms or reinforcement with concrete in advance of pouring.

H. Pumped Concrete - All concrete placed by pumping method shall be proportioned in accordance with the provisions of ACI 211.1 to meet the requirements of strength, slump, and air content in these specifications. Test cylinders for strength and tests for slump air content shall be taken at the point of discharge from the pumping line.

I. Concrete shall not be allowed to drop freely more than 6 feet. Provide pour holes in formwork for placement of concrete where the drop exceeds 6 feet.

J. Chute shall be thoroughly cleaned before and after each run. All waste materials and flushing water shall be discharged outside of the forms.

K. After form removal, all tie holes and other repairable defective areas shall be immediately patched.

3.06 COMPACTION AND VIBRATION

A. Concrete shall be compacted with the aid of mechanical internal vibrating equipment supplemented by hand spading, rodding and tamping to force out air pockets, to work the materials into the corners and around reinforcement and embedded items, and to eliminate honeycomb.

3.07 COLD WEATHER PLACEMENT

A. In temperatures of 40 deg. F. and above, when it is not anticipated that temperatures will drop below 40 deg. F, comply with the requirements of ACI.

B. For temperatures below 40 deg. F, concrete must be delivered to the project site between 55 deg. F. and 70 deg. F, comply with the requirements of ACI. Water shall not be heated over 180 deg. F.

C. Use only the specified non-corrosive, non-chloride accelerator. Calcium Chloride, thiocoyanates or admixtures containing more than 0.05% chloride ions are not permitted.

D. All methods proposed for heating materials and protecting the concrete shall be subject to approval by the Structural Engineer. Concrete shall never be heated over 90 deg. F, nor will any other overheating which would produce a flash set be permitted.

E. Do not place concrete on frozen subgrade or subgrade containing frozen materials, snow or ice.

3.08 WARM AND INCLEMENT WEATHER PLACEMENT

A. During hot weather, the concrete shall be delivered to the forms at the coolest practicable temperature. In no case shall concrete above 90 deg. F. be placed. When high temperatures and/or placing conditions dictate, the Contractor shall use the water-reducing, retarding formulation (Type D) in lieu of the specified water-reducing admixture (Type A) as specified. Concrete shall not be placed when the sun, heat, wind, rain, sleet, or humidity would prevent proper placement.

3.09 CONCRETE FINISHES

A. Troweled Finish: All concrete slabs, except as noted below, but including those that shall receive resilient flooring, tile with a thin set application, or carpet shall be screeded level to the established elevations, thoroughly consolidated and bullfloated. When slabs have set sufficiently, machine float and then trowel with a steel trowel. Concrete shall be in condition acceptable to trades that will furnish and install the finish materials.

1. During the floating and troweling operations, care shall be taken that no holes or depressions are left from the removal of coarse aggregate and that no excess moisture or bleed water is present on the surface. The trowel finished surface shall be level so that the surface conforms to an F25 number as measured by the "Dipstick" or an optical device approved by the Architect.

B. Scratched Finish: For slab surfaces intended to receive bonded applied "mud set" cementitious applications, ceramic tile or quarry tile, etc., after concrete has been placed, struck-off consolidated and leveled, the surface shall be roughened with stiff brushes or rakes before final set.

3.10 FINISHES OTHER THAN FLOORS

A. Smooth Finish: All vertical concrete surfaces that will be exposed as finished work shall receive a smooth finish. This shall be achieved by the use of steel forms or new smooth plywood. Sheets shall be as large as possible with smooth even edges and installed with close joints. Joint marks and fins shall be ground off and surfaces left smooth, dense, and free from honeycombing, prominent grain marking, and bulges or depressions more than 1/8" in 4 feet. Surfaces shall then be patched, leaving the surface finish uniformly smooth and washed clean.

B. Rough Finish: Rough concrete finish shall be used for all other concrete for which no other finish is indicated or specified. Obtain by using clean, straight lumber, plywood, or metal forms. Concrete having a rough finish shall have honeycombing and minor defects patched.

3.11 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Immediately after placing and finishing, concrete surfaces not covered by forms, or when forms are removed within three days of placement, shall be protected from the loss of surface moisture for a period of not less than seven days by covering with the curing compound specified.

2. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.

3.12 REPAIR OF DEFECTIVE AREAS

A. All Structural repairs shall be made with prior approval of the Structural Engineer, as to method and procedure.

3.13 REDESIGN

A. Changes or departures from the construction details shown on the drawings shall be made only with the approval of the Structural Engineer.

B. Changes will not be allowed to be made on shop drawings that have been previously submitted for approval except for items that have been noted for corrections or coordination.

3.14 BONDING

A. Before new concrete is deposited on or against concrete that has hardened, the form shall be retightened, the surfaces of the hardened concrete shall be roughened as required, thoroughly cleansed of foreign matter and laitance, and slushed with cement grout.

PART 4 - QUALITY CONTROL TESTING

4.01 TESTING AND INSPECTION

A. General: The Owner shall pay for the services of a test laboratory for selected by the Owner for concrete quality control as enumerated in this specification. The test laboratory shall submit proof that any concrete inspectors used on the project shall have taken and passed the ACI course in Concrete Inspection within the past five years. The test laboratory services shall include the following:

1. The testing laboratory shall provide continuous inspection and testing of ingredients used in concrete.

2. The test laboratory shall keep a man on the job site for the full length of all concrete placements and if requested, shall check the batching plant quantities and measurements at the beginning of each day's placement.

3. The test laboratory shall make tests during the progress of the work and shall check for adequate mixing of all concrete placed.

B. Codes: The testing laboratory, will test the concrete for compliance with contract documents and all applicable ACI and ASTM codes and standards.

C. Understrength Concrete: If test cylinders fail to meet the strength requirements and/or if, in the opinion of the Structural Engineer, the cylinders are not truly representative of the inplace concrete the Architect has right to request that cores be cut from the work affected. Such cores shall be not less than 3 in number and shall comply as to size and

shape and shall be secured and tested in conformance with the requirements of ASTM C42. The cores shall be taken at points mutually agreeable to the Contractor and the Architect, and shall be tested at points mutually agreeable to the Contractor and the Architect, and shall be tested in the presence of the Architect by a laboratory approved by the Architect. If test results are not satisfactory to the Architect, this Contractor shall remove from the work all affected concrete and replace such defective work in a satisfactory manner, all without further compensation or time extension including the costs of coring, testing and all related architectural and engineering work.

D. Contractor's Responsibility: The sole responsibility for producing concrete in the field having the strength required without causing excessive shrinkage cracks shall rest on the Contractor, regardless of the laboratory determination. If, in his opinion, the field conditions are such that a lower water-cement ratio is necessary to produce the required strength, he shall submit the mix he proposes to use to the Architect in writing. In no case will the Contractor be permitted to use a higher water-cement or lower cement factor than those used in the approved mix.

E. Re-dosage with the high range water reducing admixture (superplasticizer) may be permitted with the approval of the Engineer as to methods and procedures.

4.02 TESTING DURING PROGRESS OF WORK

A. If requested, batch plant inspection by the testing laboratory will include:

1. Attendance at the batching plant during all batching.

2. Determination that all weighing and measuring equipment is in proper working order and that calibration certificates of scales are current.

3. Determination that the truck mixers are regularly cleaned and maintained and that the drums revolve at the proper speeds. Provide the Joint Venture with a list of trucks certified in accordance with ASTM C-94. No mixers with accumulations of hardened concrete on the blades or with worn or defective blades shall be permitted on this project.

4. Ascertain that only correct weights of cement and aggregate are used.

5. Ascertain that only those admixtures as specified and in proper qualities are used in the mix.

6. Insure that only the correct amount of mixing water is loaded into the tank of the truck.

7. Insure that only approved materials are used.

8. Ascertain that aggregates and water are of the proper temperature.

9. Make necessary tests of the aggregates to determine the moisture content so that the total water in the batch may be properly adjusted.

10. Test of aggregates received at the batching plant for gradation and cleanliness.

11. Check and sign delivery tickets issued by supplier that will identify each load of concrete dispatched to the project as having been inspected.

B. Field Inspection by the Testing Laboratory will include:

1. Attendance at the project site during all concrete placing operations.

2. Ascertain that concrete delivered to the site has been inspected by the batch plant inspector.

3. Control the addition of mixing water in order to maintain the required water/cement ratio.

4. Ascertain that the concrete is mixed in accordance with the specification requirements.

5. Insure that the concrete is conveyed from the mixer to the point of pour in accordance with specifications and good practice.

6. Insure that the concrete is of the proper temperature when placed.

7. Air Content Tests - At least two tests shall be made for each day's placing or from each batch of concrete from which cylinders are cast. Tests shall be representative of each type of concrete.

8. Slump Tests - At frequent intervals to properly control the consistency and at least one at time of casting each group of cylinders and at least one test for every 25 cubic yards.

C. Concrete Compression Cylinders: Unless otherwise specified, there shall be taken from the concrete of each strength placed on any one day at least one set of five representative 6" x 12" test cylinders. For large placements on any one day there shall be taken not less than one set of five representative type cylinders for each 100 cubic yard of concrete of each strength placed. Two cylinders to be tested at 7 days, two at the age of 28 days and the fifth cylinder in reserve for further testing. Ascertain that the test specimens are properly protected until shipped to the testing laboratory. Record and identify each cylinder with the location of the concrete from which the specimen was taken. Keep marking in sequence.

D. Additional Test Lab Responsibilities: Report any material or work performed that fails to meet the job specifications immediately with the Contractor, and then to the Architect. Work will be checked as it progresses. Failure to detect any defective work or materials shall not in any way prevent later rejections or obligate the Owner for final acceptance.

E. Reports on Inspection: Submit reports on testing and inspection. Reports shall include detailed data with respect to all requirements of the specifications referenced. Materials or workmanship not meeting the requirements of the Contract Documents, either at the plant or project site, will be rejected by the Testing Laboratory and immediately reported to the Contractor and then to the Architect. In no case shall the laboratory recommend any method of adjustment or correction without obtaining prior approval of the Architect. Include in all reports and project title and number, location, Contractor's name, and date work was performed.

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F. Report Copies and Timing: Immediately after tests or inspections have been made and in no case late than seven (7) days after tests of inspection have been made, the laboratory shall furnish copies of all test and inspection reports.

1. One (1) copy to Architect.

2. One (1) copy to the Contractor.

3. One (1) copy to Master Consulting Engineers, Inc.

4. One (1) copy to Concrete Contractor.

5. One (1) copy to the Owner.

G. Batch Plant Inspection Daily Report: The batch plant inspectors shall submit a daily report which shall contain the following data:

1. Concrete supplier.

2. Weather conditions and air temperature (ranges).

3. Type of concrete.

4. Required strength of concrete.

5. Total number of batches, batch weight, and identifying number of each batch and truck load.

6. Basic control data concrete mix, indicating mix number source, and type of cement, source of aggregates, type of admixtures, basic quantities of cement, aggregates (dry), water and admixtures of concrete per cubic year, required slump, required air entrainment and water/cement ratio.

7. Actual data and quantities of concrete batch, indicating time of batching, actual quantities of cement, aggregates (moist) and admixtures, gallons of water added to plant; percent of total moisture in aggregates; temperature of aggregates and water, gallons of water to be added in transit or at site; time truck dispatched from plant.

8. Name of inspector, with time of arrival and departure from batch plant and total hours for day.

H. Site Inspection Daily Report: The site inspectors shall submit a daily report which shall contain the following data:

1. Concrete supplier.

2. Weather conditions and air temperature (ranges).

3. Class and type of concrete placed.

4. Location of placed concrete and time of starting and stopping of placement.

5. Identification of truck loads.

6. Time of dispatching truck from batching plant and receipt of delivery tickets. Indicate delivery ticket number.

7. Amount of water added in transit or at site.

8. Time of discharging concrete from truck.

9. Temperature of concrete during discharging from truck and during placing.

10. Slump test results, identifying truck load and cylinders made.

11. Air entrainment test results, identifying truck load.

12. Test cylinders cast, identifying cylinder number, design strength, time taken, slump, truck numbers from which taken and location of pours with yardage of concrete placed at each location.

13. Weight per cubic foot of plastic concrete.

14. Other pertinent data which may have bearing on quality or strength of concrete, placing of concrete, and also report if any concrete was rejected.

15. Name of inspector, with time of arrival and departure from site and total hours for day.

4.03 CONTRACTOR'S RESPONSIBILITIES AND OBLIGATIONS RELATIVE TO CONCRETE MIX DESIGNS

A. This Contractor shall submit preliminary mix designs for the concrete proposed on this project for review.

B. The preliminary mix design shall be prepared by a concrete test lab and shall be based on the actual materials used as submitted by this Contractor.

C. Furnish an insulated weatherproof box for storing field test.

D. The test lab cost for the above shall be borne by this Contractor.

4.04 THE TESTING LABORATORY SHALL FURNISH ALL REQUIRED CYLINDER MOLDS AND TAGS TO BE USED FOR MIX DESIGNS AND FIELD TESTS.

END OF SECTION 03 00 00

SECTION 03 29 00
UNDER-SLAB VAPOR BARRIER/RETARDER

PART 1 – GENERAL

1.01 SUMMARY

A. Products Supplied Under This Section
   1. Vapor Barrier, seam tape, pipe boots, detail strip for installation under concrete slabs.

1.02 RELATED DOCUMENTS

A. Specification 03 30 00 Cast-in-Place Concrete

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM)
   1. ASTM E 1745-97 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil
      Or Granular Fill Under Concrete Slabs
   2. ASTM E 154-88 Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs
   3. ASTM E 96-95 Standard Test Methods for Water Vapor Transmission of Materials
   4. ASTM E 1643-98 Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs

B. American Concrete Institute (ACI)
   1. ACI 302.1R-96 Vapor Barrier Component

1.04 SUBMITTALS

A. Quality Control / Assurance
   1. Independent laboratory test results showing compliance with ASTM & ACI Standards.
   2. Manufacturer's samples, literature
   3. Manufacturer's installation instructions for placement, seaming and pipe boot installation

PART 2 – PRODUCTS

2.01 MATERIALS

A. Vapor Barrier (Performance based specification)
   1. Vapor Barrier membrane must have the following properties.
      A. Minimum WVTR as tested by ASTM E96 of 0.008
      B. Water Vapor Barrier ASTM E-1745 Meets or exceeds Class B
      D. Water Vapor Transmission Rate ASTM E-96 0.006 gr./ft^2/hr. or lower
      E. Permeance Rating ASTM E-96 0.01 gr./ft^2/hr. or lower
      F. Puncture Resistance ASTM E-1745 minimum 1970 grams
      G. Tensile Strength ASTM E-1745 minimum 45.0 lbf/in
   2. Vapor Barriers
      A. Stego (15mil) Vapor Barrier by STEGO INDUSTRIES LLC.
      B. W.R. Meadows Premoulded Membrane with Plasmatic Core
      C. Vaporguard by Reef industries.

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2.02 ACCESSORIES

A. Seam Tape
   1. High Density Polyethylene Tape with pressure sensitive adhesive. Minimum width 4 inches.

B. Pipe Boots
   2. Construct pipe boots from vapor barrier material and pressure sensitive tape per manufacturer's instructions.

PART 3 – EXECUTION

3.01 PREPARATION

A. Ensure that subsoil is approved by architect
   1. Level and tamp or roll aggregate, sand or tamped earth base.

3.2 INSTALLATION

A. Install Vapor Barrier:
   1. Installation shall be in accordance with manufacturer's instructions and ASTM E 1643–98.

      A. Unroll Vapor Barrier with the longest dimension parallel with the direction of the pour.
      B. Lap Vapor Barrier over footings and seal to foundation walls.
      C. Overlap joints 6 inches and seal with manufacturer's tape.
      D. Seal all penetrations (including pipes) with manufacturer's pipe boot.
      E. No penetration of the vapor barrier is allowed except for reinforcing steel and permanent utilities.
      F. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 6 inches and taping all four sides with tape.

END OF SECTION 03 29 00

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SECTION 03 30 00 – CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section specifies cast-in-place concrete, including framework, reinforcing, mix design, placement procedures and finishes.

B. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, dry-shake finish materials and others as requested by Architect.

C. Shop drawings for reinforcement, prepared by registered Professional Engineer for fabrication, bending and placement of concrete reinforcement. Comply with ACI SP-66 (88), “ACI Detailing Manual,” showing bar schedules, stirrup spacing, diagrams of bent bars and arrangement of concrete reinforcement. Include special reinforcement required for openings through concrete structures.

D. Shop drawings for formwork, prepared by a registered Professional Engineer for fabrication and erection of forms for specific finished concrete surfaces. Show form construction including jointing, special form joint or reveals, location and pattern of form tie placement and other items that affect exposed concrete visually.

1. Architect’s review is for general architectural applications and features only. Design of formwork for structural stability and efficiency is Contractor’s responsible.

E. Samples of materials as requested by Architect, including names, sources and descriptions as follows:

1. Normal weight aggregates.
2. Fibrous reinforcement.
3. Reglets
4. Waterstops.
5. Vapor retarder.

F. Laboratory test reports for concrete materials and mix design tests.

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F. Materials certificates in lieu of materials laboratory test reports when permitted by Architect. Materials certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with or exceeds specific requirements. Provide certification from admixture manufacturer that chloride content complies with specification requirements.

G. Materials certificates in lieu of materials laboratory test reports when permitted by Architect. Materials certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements. Provide certification from admixture manufacturers that chloride content complies with specification requirements.

1.04 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of following codes, specifications and standards, except where more stringent requirements are shown or specified:

1. ACI 318, “Building Code Requirements for Reinforced Concrete.”
2. Concrete Reinforcing Steel Institute (CRSI), “Manual of Standard Practice.”

B. Concrete Testing Service: Engage a testing laboratory acceptable to Architect to perform material evaluation tests and to design concrete mixes.

C. Materials and installed work may require testing and retesting at any time during progress or work. Tests, including retesting of rejected materials for installed work, shall be done at Contractor’s expense.

PART 2 - PRODUCTS

2.01 FORM MATERIALS

A. Forms for Exposed Finish Concrete: Plywood, metal-framed plywood faced or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system show on drawings.

1. Use overlaid plywood complying with U.S. Product Standard PS-1 “A-C or B-B High Density Overlaid Concrete Form,” Class I.

2. Use plywood complying with U.S. Product Standard PS-1 “B-B (Concrete Form) Plywood,” Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.

B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.

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C. Form Coatings: Provide commercial formulation form-coating compounds with a maximum VOC of 350 mg/l that will not bond with, stain or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

D. Form Ties: Factory-fabricated, adjustable length, removable or snap-off metal form ties, designed to prevent form deflection and to prevent spalling concrete upon removal. Provide units that will leave no metal closer than 1-1/2 inches to exposed surface.

1. Provide ties that, when removed, will leave holes no larger than 1-inch diameter in concrete surface.

2.02 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

B. Galvanized Reinforcing Bars: ASTM A 767, Class II (2.0 oz. zinc psf) hot-dip galvanized, after fabrication and bending.

C. Epoxy-Coated Reinforcing Bars: ASTM A 775.

D. Steel Wire: ASTM A 82, plain, cold-drawn steel.

E. Welded Wire Fabric: ASTM A 185, welded steel wire fabric.

F. Welded Deformed Steel Wire Fabric: ASTM A 497.

G. Supports for Reinforcement: Bolsters, chairs, spacer and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use wire-bar-type supports complying with CRSI specifications.

1. For slabs-in-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.

2. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs that are plastic protected (CRSI, Class 1) or stainless steel protected (CRSI, Class 2)

2.03 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I.

1. Use one brand of cement throughout project unless otherwise acceptable to Architect.

B. Fly Ash: ASTM C 618, Type C or Type F.

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C. Normal Weight Aggregates: ASTM C 33 and as herein specified. Provide aggregates from a single source or exposed concrete.

1. For exterior exposed surfaces, do not use fine or coarse aggregates containing spalling-causing deleterious substances.

2. Local aggregates not complying with ASTM C 33 but that special tests or actual service have shown to produce concrete of adequate strength and durability may be used when acceptable to Architect.

D. Lightweight Aggregates: ASTM C 330.

E. Water: Drinkable.

F. Admixtures, General: Provide admixtures for concrete that contain not more than 0.1 percent chloride ions.

G. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements provide one of the following:

a. "Air-Tite," Cormix.

b. "Air-Mix" or "Perma-Air," Euclid Chemical Co.

c. "Darex AEA" or "Daravair," W.R. Grace & Co.

d. "MB-VR" or "Micro-Air," Master Builders, Inc.

e. "Sealtight AEA," W.R. Meadows, Inc.

f. "Sika AER," Sika Corp.

H. Water-Reducing Admixture: ASTM C 494, Type A.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the work include, but are not limited to, the following:

2 Products: Subject to compliance with requirements, provide one of the following:

a. "Chemtard," ChemMasters Corp.

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b. “PSI N,” Cormix.

c. “Eucon WR-75,” Euclid Chemical Co.

d. "WRDA," W.R. Grace & Co.

e. "Pozzolith Normal" or "Polyheed," Master Builders, Inc.

f. "Prokrete-N," Prokrete Industries.

g. "Plastocrete 161," Sika Corp.

I. High-Range Water-Reducing Admixture (Super Plasticizer): ASTM C 494, Type F or Type G.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

a. "Super P," Anti-Hydro Co., Inc.

b. "PSI Super," Cormix.

c. "Eucon 37," Euclid Chemical Co.

d. "WRDA 19" or "Daracem," W.R. Grace & Co.

e. "Rheobuild," Master Builders, Inc.

f. "PSP," Prokrete Industries.

g. "Sikament 300," Sika Corp.

J. Water-Reducing, Accelerating Admixture: ASTM C 494, Type E.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

a. "Q-Set," Conspec Marketing & Manufacturing Co.

b. "Gilco Accelerator," Cormix.

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c. "Accelguard 80," Euclid Chemical Co.

d. "Daraset," W.R. Grace & Co.

e. "Pozzutec 20," Master Builders, Inc.

K. Water-Reducing, Retarding Admixture: ASTM C 494, Type D.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

a. "PSI-R Plus," Cormix.

b. "Eucon Retarder 75," Euclid Chemical Co.

c. "Daratard-17," W.R. Grace & Co.

d. "Pozzolith R," Master Builders, Inc.

e. "Protard," Prokrete Industries.

f. “Plastiment," Sika Corporation.

L. Fibrous Reinforcement: Engineered polypropylene fibers designed for secondary reinforcement of concrete slabs.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

a. "Fiberstrand 100," Euclid Chemical Co.

b. "Fibermesh," Fibermesh, Inc.

c. "Forta CR," Forta Corp.

d. "Grace Fibers," W.R. Grace & Co.

2.04 RELATED MATERIALS

A. Reglets: Where resilient or elastomeric sheet flashing or bituminous membranes are terminated in reglets, provide reglets of not less than 0.0217 inch thick (26-gage)

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galvanized sheet steel. Fill reglet or cover face opening to prevent intrusion of concrete or debris.

B. Waterstops: Provide flat, dumbbell-type or centerbulb-type waterstops at construction joints and other joints as indicated. Size to suit joints.

C. Rubber Waterstops: Corps of Engineers CRD-C 513.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

a. The Burke Co.

b. Progress Unlimited

c. Williams Products, Inc.

D. Polyvinyl Chloride Waterstops: Corps of Engineers CRD-C 572

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

a. The Burke Co.

b. Greenstreak Plastic Products Co.

c. W.R. Meadows, Inc.

d. Progress Unlimited

e. Schlegel Corp.

f. Vinylex Corp.

E. Granular Base: Evenly graded mixture of fine and coarse aggregates to provide, when compacted, a smooth and even surface below slabs on grade.

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F. Sand Cushion: Clean, manufactured or natural sand.

G. Vapor Retarder: Provide vapor retarder cover over prepared base material where indicated below slabs on grade. Use only materials that are resistant to deterioration when tested in accordance with ASTM E 154, as follows:

1. Polyethylene sheet not less than 8 mils thick.

2. Water-resistant barrier consisting of heavy Kraft papers laminated together with glass-fiber reinforcement and overcoated with black polyethylene on each side.

a. Product - "Moistop," Fortifiber Corp.

H. Vapor Barrier: Premoulded membrane, seven-ply construction consisting of reinforced core and carrier sheet with fortified bitumen layers, protective weathercoating and plastic antistick sheet. Water vapor transmission rate of 0.00 grains/sq. ft./hr. when tested in accordance with ASTM E 96, Method B. Provide manufacturer's recommended mastics and gusset tape.

1. Product: "Sealtight Premoulded Membrane With Plasmatic Core," W.R. Meadows, Inc.

I. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.

J. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.

a. Waterproof paper.

b. Polyethylene film.

c. Polyethylene-coated burlap.

K. Liquid Membrane-Forming Curing Compound: Liquid-type membrane- forming curing compound complying with ASTM C 309, Type I, Class A. Moisture loss not more than 0.055 gr./sq. cm. when applied at 200 sq. ft./gal.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

a. "A-H 3 Way Sealer," Anti-Hydro Co., Inc.

b. "Spartan-Cote," The Burke Co.

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c. "Conspec #1," Conspec Marketing & Mfg. Co.

d. "Hardtop," Cormix.

e. "Day-Chem Cure and Seal," Dayton Superior Corp.

f. "Kurez DR VOX" Euclid Chemical Co.

g. “Kurez DR-100” Euclid Chemical Co.

h. "Horn Clear Seal," A.C. Horn, Inc.

i. "L&M Cure," L & M Construction Chemicals, Inc.

j. "Masterkure," Master Builders, Inc.

k. "CS-309," W.R. Meadows, Inc.

l. "LR-151," Prokrete Industries.

m. "Kure-N-Seal," Sonneborn-Rexnord.

n. "Stontop CS2," Stonhard, Inc.

L. Water-Based Acrylic Membrane Curing Compound: ASTM C 309, Type I, Class B.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

a. "Conhard," Conspec Marketing and Mfg. Co.

b. "Safe Cure and Seal," Dayton Superior Corp.

c. "Aqua-Cure," Euclid Chemical Co.

d. "Dress & Seal #18WB," L&M Construction Chemicals, Inc.

e. "Masterseal W," Master Builders, Inc.

f. "Intex," W.R. Meadows, Inc.

g. "Sika Membrane," Sika Corp.

M. Evaporation Control: Monomolecular film-forming compound applied to exposed concrete

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slab surfaces for temporary protection from rapid moisture loss.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

   a. "Eucobar," Euclid Chemical Co.
   b. "E-Con," L&M Construction Chemicals, Inc.
   c. "Confilm," Master Builders, Inc.

N. Underlayment Compound: Free-flowing, self-leveling, pumpable, cement-based compound for applications from one inch thick to feathered edges.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

   a. "K-15," Ardex, Inc.
   b. "Conflow," Conspec Marketing and Mfg. Co.
   c. "LevelLayer II," Dayton Superior Corp.
   d. "Flo-Top," Euclid Chemical Co.

   e. "Levelex," L&M Construction Chemicals, Inc.
   f. Pourcrete," Master Builders, Inc.
   g. "Stoncrete UL1," Stonhard, Inc.
   h. "Thoro Underlayment Self-Leveling," Thoro System Products.

O. Bonding Compound: Polyvinyl acetate or acrylic base.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

   a. Polyvinyl Acetate (Interior Only):

      1. "Superior Concrete Bonder," Dayton Superior Corp.

      2. "Euco Weld," Euclid Chemical Co.

      3. "Weld-Crete," Larsen Products Corp.

      4. "Everweld," L&M Construction Chemicals, Inc.

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b. Acrylic or Styrene Butadiene:

1. "Acrylic Bondcrete," The Burke Co.
2. "Strongbond," Conspec Marketing and Mfg. Co.
3. "Day-Chem Ad Bond," Dayton Superior Corp.
4. "SBR Latex," Euclid Chemical Co.
5. "Daraweld C," W.R. Grace & Co.
6. "Hornweld," A.C. Horn, Inc.
7. "Everbond," L & M Construction Chemicals, Inc.
8. "Acryl-Set," Master Builders Inc.
9. "Intralok," W.R. Meadows, Inc.
10. "Sonocrete," Sonneborn-Rexnord.
11. "Stonlock LB2," Stonhard, Inc.

P. Epoxy Adhesive: ASTM C 881, two-component material suitable for use on dry or damp surfaces. Provide material "Type," "Grade," and "Class" to suit project requirements.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

a. "Burke Epoxy M.V.," The Burke Co.

b. "Spec-Bond 100," Conspec Marketing and Mfg. Co.

c. "Euco Epoxy System #452 or #620," Euclid Chemical Co.

d. "Epoxtite Binder 2390," A.C. Horn, Inc.

e. "Epabond," L&M Construction Chemicals, Inc.

f. "Concresive 1001," Master Builders, Inc.

f. "Sikadur 32 Hi-Mod," Sika Corp.

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2.05 PROPORTIONING AND DESIGN OF MIXES

A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If trial batch method used, use an independent testing facility acceptable to Architect for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing.

1. Limit use of fly ash to not exceed 25 percent of cement content by weight.

B. Submit written reports to Architect of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until proposed mix designs have been reviewed by Architect.

C. Design mixes to provide normal weight concrete with the following properties, as indicated on drawings and schedules:

1. 4000-psi, 28-day compressive strength; W/C ratio, 0.44 maximum (non-air-entrained), 0.35 maximum (air-entrained).

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2. 3500-psi, 28-day compressive strength; W/C ratio, 0.51 maximum (non-air-entrained), 0.40 maximum (air-entrained).

3. 3000-psi, 28-day compressive strength; W/C ratio, 0.58 maximum (non-air-entrained), 0.46 maximum (air-entrained).

4. 2500-psi, 28-day compressive strength; W/C ratio, 0.67 maximum (non-air-entrained), 0.54 maximum (air-entrained).

D. Lightweight Concrete - Proportion mix as specified. Design mix to produce strength and modulus of elasticity as noted on drawings, with a splitting tensile strength factor (Fct) of not less than 5.5 for 3000-psi concrete and a dry weight of not less than 95 lbs. or more than 110 lbs. after 28 days. Limit shrinkage to 0.03 percent at 28 days.

E. Adjustment to Concrete Mixes - Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in work.

2.06 ADMIXTURES

A. Use water-reducing admixture or high-range water-reducing admixture (Superplasticizer) in concrete as required for placement and workability.

B. Use nonchloride accelerating admixture in concrete slabs placed at ambient temperatures below 50 deg F (10 deg C).

C. Use high-range water-reducing admixture (HRWR) in pumped concrete, concrete for industrial slabs, architectural concrete, parking structure slabs, concrete required to be watertight, and concrete with water/cement ratios below 0.50.

D. Use air-entraining admixture in exterior exposed concrete unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of plus or minus 1-1/2 percent within following limits:

1. Concrete structures and slabs exposed to freezing and thawing, deicer chemicals, or hydraulic pressure:

   a. 4.5 percent (moderate exposure); 5.5 percent (severe exposure) 1-1/2-inch max. aggregate.

   b. 4.5 percent (moderate exposure); 6.0 percent (severe exposure) 1-inch max. aggregate.

   c. 5.0 percent (moderate exposure); 6.0 percent (severe exposure) 3/4-inch max. aggregate.

2. Other concrete (not exposed to freezing, thawing or hydraulic pressure or to receive a surface hardener: 2 percent to 4 percent air.

E. Use admixtures for water reduction and set control in strict compliance with Manufacturer's directions.

F. Water-Cement Ratio – Provide concrete for following conditions with maximum water-cement (W/C) ratios as follows:

1. Subjected to freezing and thawing; W/C 0.45.

2. Subjected to deicers/watertight; W/C 0.40

3. Subjected to brackish water, salt spray or deicers; W/C 0.40.

G. Slump Limits – Proportion and design mixes to result in concrete slump at point of placement as follows:

1. Ramps, slabs and sloping surfaces – not more than 3 inches.

2. Reinforced foundation systems - Not less than 1 inch and not more than 3 inches.

3. Concrete containing HRWR admixture (Superplasticizer) - Not more than 8 inches after addition of HRWR to site-verified 2-inch to 3-inch slump concrete.

4. Other concrete - Not more than 4 inches.

2.07 CONCRETE MIXING

A. Job-Site Making – Mix materials for concrete in appropriate drum-type batch machine mixer. For mixers of one cubic yard or smaller capacity, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released. For mixers of capacity larger than one cubic yard, increase minimum 1-1/2 minutes of mixing time by 15 seconds for each additional cubic yard or fraction thereof.

B. Provide batch ticket for each batch discharged and used in work, indicating project identification name and number, date, mix type, quantity and amount of water introduced.

C. Ready-Mix Concrete – Comply with requirements of ASTM C 94, and as specified.

1. When air temperature is between 85 deg F (30 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 – EXECUTION

3.01 GENERAL

A. Coordinate the installation of joint materials and vapor retarders with placement of forms and reinforcing steel.

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3.02 FORMS

A. General – Design, erect, support, brace and maintain formwork to support vertical and lateral, static and dynamic loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation and position. Maintain formwork construction tolerances complying with ACI 347.

B. Construct forms to sizes, shapes, lines and dimensions shown to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent leakage of cement paste.

C. Fabricate form for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.

D. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

E. Chamfer exposed corners and edges, as indicated, using wood, metal, PVC or rubber chamfer strips fabricated to produce uniform smooth keyways, reglets, recesses, and the like, for easy removal.

F. Provisions for Other Trades – Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such items. Accurately place an securely support items built into forms.

G. Cleaning and Tightening – Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Retighten forms and bracing before concrete placement as required to prevent mortar leaks and maintain proper alignment.

3.03 VAPOR RETARDER/BARRIER INSTALLATION

A. General – Following leveling and tamping of granular base for slabs-on-grade, place vapor retarder/barrier sheeting with longest dimension parallel with direction of pour.

B. Lap joints 6 inches and seal vapor barrier joint with manufacturer’s recommended mastic and pressure-sensitive tape.

C. After placement of vapor retarder/barrier, cover with sand cushion and compact to depth as shown on drawings.

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3.04 PLACING REINFORCEMENT

A. General – Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as herein specified.

1. Avoid cutting or puncturing vapor retarder during reinforcement placement and concreting operations.

B. Clean reinforcement of loose rust and mill scale, earth, ice and other materials that reduce or destroy bond with concrete.

C. Accurately position, support and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangars, as approved by Architect.

D. Place reinforcement to obtain at least minimum coverages for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so that ends are directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.05 JOINTS

A. Construction Joints – Locate and install construction joints as indicated or, if not indicated, locate so as not to impair strength and appearance of the structure, as acceptable to Architect.

B. Provide keyways at least 1-1/2 inches deep in construction joints in walls and slabs and between walls and footings. Accepted bulkheads designed for this purpose may be used for slabs.

C. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as otherwise indicated. Do not continue reinforcement through sides of strip placements.

D. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.

E. Waterstops – Provide waterstops in construction joints as indicated. Install waterstops to form continuous diaphragm in each joint. Make provisions to support and protect exposed waterstops during progress of work. Field-fabricate joints in waterstops in accordance with manufacturer's printed instructions.

F. Isolation Joints in Slabs-On-Ground – Construct isolation joints in slabs-on-ground at points of contact between slabs-on-ground and vertical surfaces, such as column pedestals, foundation walls, grade beams and elsewhere as indicated.

G. Joint filler and sealant materials are specified in Division 7 Sections of these specifications.

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H. Contraction (Control) Joints in Slabs-On-Ground: Construct contraction joints in slabs-on-ground to form panels of patterns as shown. Use saw cuts 1/8 inch wide by ¼ slab depth or inserts ¼ inch wide by ¼ of slab depth, unless otherwise indicated.

1. Form contraction joints by inserting premoulded plastic, hardboard or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.

2. Contraction joints in unexposed floor slabs may be formed by saw cuts as soon as possible after slab finishing as may be safety done without dislodging aggregate.

3. If joint pattern not shown, provide joints not exceeding 15 feet in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third bays).

4. Joint sealant material is specified in Division 7 Sections of these specifications.

3.06 INSTALLATION OF EMBEDDED ITEMS

A. General – Set and build into work anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of items to be attached thereto.

B. Install reglets to receive top edge of foundation sheet waterproofing and to receive thru-wall flashings in outer face of concrete frame at exterior walls, where flashing is show at lintels, relieve angles and other conditions.

C. Forms for Slabs – Set edge forms, bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting-type screeds.

3.07 PREPARATION OF FORM SURFACES

A. General – Coat contact surfaces of forms with an approved, non-residual, low-VOC, form-coating compound before reinforcement is placed.

B. Do not allow excess form-coating materials to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer’s instructions.

C. Coat steel forms with a non-staining, rust-preventative material. Rust-stained steel formwork is not acceptable.

3.08 CONCRETE PLACEMENT

A. Inspection – Before placing concrete, inspect and complete formwork installation, reinforcing steel and items to be embedded or cast in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work.

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B. General – Comply with ACI 304, “Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete,” and as herein specified.

C. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete that ahs hardened sufficiently to cause to formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete to avoid segregation at its final location.

D. Placing Concrete in Forms – Deposit concrete in forms in horizontal layers not deeper than 24 inches and in a manner to avoid inclines construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

1. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309.

2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

E. Placing Concrete Slabs – Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.

1. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

2. Bring slab surfaces to correct level with straightedge and strike off. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.

3. Maintain reinforcing in proper position during concrete placement.

F. Cold-Weather Placing – Comply with provisions of ACI 206 and as follows: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions or low temperatures.

G. When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.

1. Do not use frozen materials or materials containing ice or snow. Do not place chemical accelerators unless otherwise accepted in mix designs.

H. Do not use calcium chloride, salt and other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

I. Hot-Weather Placing – When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 deg F (32 deg C). Mixing water may be chilled or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing water. Use of liquid nitrogen to cool concrete is Contractor's option.

2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.

3. Fog spray foams, reinforcing steel and subgrade just before concrete is placed.

4. Use water-reducing retarding admixture when required by high temperatures, high humidity or other adverse placing conditions, when acceptable to Architect.

3.09 FINISH OF FORMED SURFACES

A. Rough Form Finish – For formed concrete surfaces not exposed to view in the finish work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding ¼ inch in height rubbed down or chipped off.

B. Smooth Form Finish – For formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting or other similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.

C. Smooth Rubbed Finish – Provide smooth rubbed finished to scheduled concrete surfaces, which have receive smooth form finish treatment, not later than one day after form removal.

1. Moisten concrete surfaces and rub with carborundum brick or other abrasive until a uniform color and texture is produced. Do not apply cement grout other than that created by the rubbing process.

D. Grout-Cleaned Finish – Provide grout-cleaned finish to scheduled concrete surfaces that have received smooth form finish treatment.

1. Combine one part portland cement to 1-1/2 parts fine sand by volume and a 50:50 mixture of acrylic or styrene butadiene-based bonding admixture and water to consistency of thick paint. Blend standard portland cement and white portland

cement, amounts determined by trial patches, so that final color of dry grout will match adjacent surfaces.

2. Thoroughly wet concrete surfaces, apply grout to coat surfaces and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.

E. Related Unformed Surfaces – At tops of walls, horizontal offsets and similar unformed surfaces occurring adjacent to formed surfaces, strike-off smooth and finish with a texture marching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.10 MONOLITHIC SLAB FINISHES

A. Scratch Finish – Apply scratch finish to monolithic slab surfaces to receive concrete floor topping or mortar setting beds for tile, portland cement terrazzo and other bonded applied cementitious finish flooring material and as otherwise indicated.

B. After placing slabs, plain surface to tolerances for floor flatness (Ff) of 15 and floor levelness (Fl) of 13. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set with stiff bristles, brooms or rakes.

C. Float Finish – Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes hereinafter specified; slab surfaces to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo; and as otherwise indicated.

1. After screeding, consolidating and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units. Check and level surface place to tolerances of Ff 18 – Fl 15. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, re-float surface to a uniform, smooth, granular texture.

D. Trowel Finish – Apply trowel finish to monolithic slab surfaces to be exposed to view and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint or other thin film finish coating system.

E. Trowel and Fine Broom Finish – Where ceramic and quarry tile is to be installed with thin-set mortar, apply trowel finish as specified, then immediately follow with slightly scarifying surface by fine brooming.

F. Nonslip Broom Finish – Apply non-slip broom finish to exterior concrete platforms, steps and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

G. After completion of float finishing and before starting trowel finish, uniformly spread 25 lbs. of dampened non-slip aggregate per 100 square feet of surface. Tap aggregate flush with surface using a steel trowel, but do not force below surface. After broadcasting and tamping, apply trowel finishing as herein specified.

H. After curing, lightly work surface with a steel wire brush, or an abrasive stone and water, to expose non-slip aggregate.

3.11 CONCRETE CURING AND PROTECTION

A. General – Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry and windy weather, protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply in accordance with manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.

C. Curing Methods – Perform curing of concrete by curing and sealing compound, by moist curing, by moisture-retaining cover curing and by combinations thereof, as herein specified.

D. Provide moisture curing by following methods:

1. Keep concrete surface continuously wet by covering with water.

2. Use continuous water-fog spay.

3. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4-inch lap over adjacent absorptive covers.

E. Provide moisture-cover curing as follows:

1. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

F. Provide curing and sealing compound to exposed interior slabs and to exterior slabs, walks and curbs as follows:

1. Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared). Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

2. Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.

G. Curing Formed Surfaces – Cure formed concrete surfaces, including underside of beams, supported slabs and other similar surfaces, by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

H. Curing Unformed Surfaces – Cure unformed surfaces, such as slabs, floor topping and other flat surfaces, by application of appropriate curing method.

I. Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture-retaining cover, unless otherwise directed.

3.12 SHORES AND SUPPORTS

A. General – Comply with ACI 347 for shoring and reshoring in multistory construction and as herein specified:

1. Extend shoring from ground to roof for structures 4 stories or less, unless otherwise permitted.

2. Extend shoring at least 3 floors under floor or roof being placed for structures over 4 stories. Shore floor directly under floor or roof being placed, so that loads from construction above will transfer directly to these shores. Space shoring in stories below this level in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members where no reinforcing steel is provided. Extend shores beyond minimum to ensure proper distributions of loads throughout structure.

3. Remove shores and reshore in a planned sequence to avoid damage to partially cured concrete. Locate and provide adequate reshoring to support work without excessive stress or deflection.

4. Keep reshores in place a minimum of 15 days after placing upper tier, and longer if required, until concrete has attained its required 28-day strength and heavy loads due to construction operations have been removed.

3.13 REMOVAL OF FORMS

A. General – Formwork not supporting weight of concrete, such as sides of beams, walls, columns and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.

B. Formwork supporting weight of concrete, such as soffits, joists, slabs and other structural elements, may not be removed in less than 14 days and until concrete has attained at least 75 percent of design minimum compressive strength at 29 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.

C. Form-facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form-facing materials without loosening or disturbing shores and supports.

3.14 REUSE OF FORMS

A. Clean and repair surfaces of forms to be reused in work. Split, frayed, delaminated or otherwise damaged form-facing materials will not be acceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use “patched” forms for exposed concrete surfaces except as acceptable to Architect.

3.15 MISCELLANEOUS CONCRETE ITEMS

A. Filling In – Fill in hole and openings left in concrete structures for passage or work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.

B. Reinforced Masonry – Provide concrete grout for reinforced masonry lintels and bond beams where indicated on drawings and as scheduled. Maintain accurate location of reinforcing steel during concrete placement.

3.16 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas – Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Architect.

1. Cut out honeycomb, rock pockets, voids over ¼ inch in any dimension and holes left by tie rods and bolts, down to solid concrete but in no case to a depth of less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water and brush-coat the area to be patched with specified bonding agent. Place patching mortar before bonding compound has dried.

2. For exposed-to-view surfaces, blend white portland cement and standard portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

B. Repair of Formed Surfaces – Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes, fill with dry-pack mortar or precast cement cone plugs secured in place with bonding agent.

1. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.

C. Repair of Unformed Surfaces – Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having required slope.

1. Repair finished unformed surfaces that contain defects that affect durability of concrete. Surface defects, as such, include crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through non-reinforced sections regardless of width, spalling, popouts, honeycomb, rock pockets and other objectionable conditions.

2. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.

3. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with patching compound. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used when acceptable to Architect.

4. Repair defective areas, except random cracks and single holes not exceeding 1 inch in diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least ¾-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

D. Repair isolated random cracks and single holes not over 1 inch in diameter by dry-pack method. Groove top of cracks and cut out holes to sound concrete and clean of dust, dirt and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Mix dry-pack, consisting of one part portland cement to 1-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Place dry-pack before bonding compound has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72 hours.

E. Perform structural repairs with prior approval of Architect for method and procedure, using specified epoxy adhesive and mortar.

F. Repair methods not specified above may be used, subject to acceptance of the Architect.

3.17 QUALITY CONTROL, TESTING DURING CONSTRUCTION

A. General – The Owner will employ a testing laboratory to perform tests and to submit test reports.

B. Sampling and testing for quality control during placement of concrete may include the following, as directed by Architect.

C. Sampling Fresh Concrete – ASTM C 172, except modified for slump to comply with ASTM C 94.

1. Slump – ASTM C 143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.

2. Air Content – ASTM C 173, volumetric methods for lightweight or normal weight concrete; ASTM C 231 pressure method for moral weight concrete; one for each day's pour of each type of air-entrained concrete.

3. Concrete Temperature – Test hourly when air temperature is 40 deg F (4 deg C) and below, when 80 deg F (27 deg C) and above and each time a set of compression test specimens is made.

4. Compression Test Specimen – ASTM C 31; one set of 4 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cure test specimens are required.

5. Compress Strength Tests – ASTM C 39; one set for each day's pour exceeding 5 cubic yards plus additional sets for each 50 cubic yards more than the first 25 cubic yards of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained for later testing if required.

6. When frequency of testing will provide fewer than 5 strength tests for a given class of concrete, conduct testing from at least 5 randomly selected batches or from each batch if fewer than 5 are used.

7. When total quantity of a given class of concrete is less than 50 cubic yards, Architect may waive strength test if adequate evidence of satisfactory strength is provided.

8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.

9. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500psi.

D. Test results will be reported in writing to Architect, Structural Engineer, Ready-Mix Producer and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and

materials, compressive breaking strength and type of break for both 7-day tests and 28-day tests.

E. Nondestructive Testing – Impact hammer, sonoscope or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

F. Additional Tests – The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed. Contractor shall pay for such tests when unacceptable concrete is verified.

END OF SECTION 03 30 00

SECTION 03 35 11 - CONCRETE FLOOR FINISHES (SEALER)

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Clear, penetrating, moisture-vapor-resistant sealers.

1.3 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Sandards for Architectural Coatings; U.S. Environemental Protection Agency; Current Edition.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 - Administrative Requirements for submittal requirements

B. Refer to Section 01 60 00.0 – Product Requirements for substitution procedures.

C. Product Data: Manufacturer's published data on each finishing product, including information on compatibility of different products and limitations.

D. Manufacturer's Instructions: Indicate manufacturer's installation instructions for preparation of substrate, application of finishing products, and requirements for polishing and protection of finished surface.

E. Manufacturer's qualification statement.

F. Installer's qualification statement.

G. Maintenance Data: Provide data on maintenance and renewal of applied finishes.

H. Specimen warranty.

I. Executed warranty.

1.6 QUALITY ASSURANCE

A. For slabs indicated to receive concrete polishing system, do not proceed with concrete polishing unless manufacturer's representative and specialized equipment is present for every day of placement.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least 3 years of documented experience.

C. Installer Qualifications: Company specializing in performing work of type specified and with at least 3 years of documented experience.

1.7 MOCK-UPS

A. For coatings, construct mock-up area under conditions similar to those that will exist during application, with coatings applied.

B. Construct mock-ups of each exposed concrete floor finish indicated on drawings, 10 feet (3 m) square.

C. Locate where directed.

D. Mock-up may remain as part of the work.

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1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's sealed packaging, including application instructions.

B. Store indoors at 50°F (10°C) to 90°F (32°C).

1.9 FIELD CONDITIONS

A. Maintain light level equivalent to a minimum 200 W light source at 8 feet (2.5 m) above the floor surface over each 20 foot (6 m) square area of floor being finished.

B. Do not finish floors until interior heating system is operational.

C. Maintain ambient temperature of 50 degrees F (10 degrees C) minimum.

D. Ventilation: Sufficient to prevent injurious gases from temporary heat or other sources affecting concrete.

1.10 WARRANTY

A. Finish Warranty: Provide five-year manufacturer warranty against excessive degradation of finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

B. Extended Correction Period: Correct defective work within 2-year period commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.1 APPLICATIONS

A. Unless otherwise indicated on drawings, finish concrete floors using clear, penetrating, moisture-vapor-resistant coating.

2.2 MANUFACTURERS

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
   1. H&C Concrete Coatings: www.hcconcrete.com

B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
   1. Interstate Products, Inc. (IPI): https://store.interstateproducts.com/safety-non-slip-coating
   2. RadonSeal: www.radonseal.com

2.3 SEALER

A. Basis of Design Product: "Pro Series" for interior and exterior use.
   1. Composition: Two-component water-based polyurethane, consisting of a resin and a hardener.
      a. 60% solids.
      b. Breathable aliphatic urethane.
   2. Resin Color: Clear (no color).
   3. Finish: Satin.
   4. Physical Properties:
      a. VOC: <50 g/L; 0.42 lb/gal mixed, per test method EPA Method 24.
      b. Abrasion Resistance: 41 mg loss, per ASTM D4060, CS17 wheel, 1,000 cycles.
      c. Pencil Hardness: 4H per ASTM D3363.
      d. Adhesion: 333 psi concrete failure, per ASTM D7234.
      e. Volume Solids: 50% ± 2%
      f. Weight Solids: 60% ± 2%

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g. Static Coefficient of Friction (without slip-resistance additive), per test method NFSI Method B101.3- 2012 and B101.1-2009:
   1) Wet SCOF .71
   2) Wet DCOF .441

5. Slip-Resistant Additive: "SHARKGRIP®" Slip-Resistant Additive.
   a. Composition: Micronized polymer.
   b. Static Coefficient of Friction, per test method NFSI Method B101.3- 2012 and B101.1-2009:
   c. Wet SCOF .68
      1) Wet DCOF .52

2.4 ENVIRONMENTAL

A. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
   1. Plastic Foam Adhesives: 50 g/L.
   2. Gypsum Board and Panel Adhesives: 50 g/L.
   3. Multipurpose Construction Adhesives: 70 g/L.
   4. Fiberglass Adhesives: 80 g/L.
   5. Contact Adhesive: 80 g/L.
   6. Other Adhesives: 250 g/L.
   7. Single-Ply Roof Membrane Sealants: 450 g/L.
   8. Nonmembrane Roof Sealants: 300 g/L.
   9. Sealant Primers for Nonporous Substrates: 250 g/L.
   10. Sealant Primers for Porous Substrates: 775 g/L.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that floor surfaces are acceptable to receive the work of this section.

B. Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes.

3.2 GENERAL

A. Apply materials in accordance with manufacturer's instructions.

3.3 COATING APPLICATION

A. Verify that surface is free of previous coatings, sealers, curing compounds, water repellents, laitance, efflorescence, fats, oils, grease, wax, soluble salts, residues from cleaning agents, and other impediments to adhesion.

B. Verify that water vapor emission from concrete and relative humidity in concrete are within limits established by coating manufacturer.

C. Protect adjacent non-coated areas from drips, overflow, and overspray; immediately remove excess material.

D. Apply coatings in accordance with manufacturer's instructions, matching approved mock-ups for color, special effects, sealing and workmanship.

E. During installation and initial cure of water-based polyurethane 2-Part clear, concrete substrate and ambient air temperatures must be between 50° F (10°C) and 90°F (32°C).
   1. Substrate temperature must be at least 5°F (3°C) above the dew point.
   2. Avoid puddling of material, which can result in white discoloration.

3.4 PROTECTION

A. Protect installed coatings from subsequent construction operations.

B. Allow 24 hours minimum dry time before opening to wheeled traffic and exposing to water.

C. Do not permit traffic over unprotected floor surface.

END OF SECTION

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SECTION 03 41 00 - PRECAST STRUCTURAL CONCRETE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this Section.

1.02 DESCRIPTION OF WORK

A. Extent of structural precast concrete work is shown on drawings. Structural precast concrete includes the following:

1. Precast seating slabs.

1.03 RELATED WORK

A. Cast-in-place concrete is specified in another Division 3 section.

B. Joint sealants and backing area specified in Division 7.

C. Applied finishes are specified in Division 9.

1.04 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of following codes, specifications and standards, except as otherwise indicated:

1. ACI 301 "Specifications for Structural Concrete for Buildings".

2. ACI 318 "Building Code Requirements for Reinforced Concrete".

3. Concrete Reinforcing Steel Institute, "Manual of Standard Practice".

4. Prestressed Concrete Institute MNL 116, "Manual for Quality Control for Plants and Production of Precast Concrete Products".

B. Fire-Resistance Rated Precast Units: Where precast concrete units are shown or scheduled as requiring a fire resistance classification, provide units tested and listed by UL in "Fire Resistance Directory".

1.05 SUBMITTALS

A. Product Data: Submit manufacturer's specifications and instructions for manufactured materials and products.

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B. Shop Drawings: Submit shop drawings showing complete information for fabrication and installation of precast concrete units.

1. Indicate layout, dimensions, and identification of each precast unit corresponding to sequence and procedure of installation.
2. Provide location and details of anchorage devices that are to be embedded in other construction.

3. Provide complete design calculations prepared by a registered Engineer, licensed in the State of Florida.

1.06 DELIVERY, STORAGE, AND HOLDING

A. Deliver precast concrete units to project site in such quantities and at such times to assure continuity of installation.

B. Deliver anchorage items which are to be embedded in other construction before start of such work.

PART 2 - PRODUCTS

2.01 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A 615, Grade 60, unless otherwise indicated.

B. Steel Wire: ASTM A 82, plain, cold-drawn, steel.

C. Welded Wire Fabric: ASTM A 185

D. Welded Deformed Steel Wire Fabric: ASTM A 497.

2.02 PRESTRESSING TENDONS

A. Uncoated, 7-wire stress-relieved strand complying with ASTM A 416. Use grade 250 unless Grade 270 indicated.

2.03 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I or Type III.

B. Aggregates: ASTM C 33.

C. Water: Drinkable.

D. Air-Entraining Admixture: ASTM C 260.

E. Water-Reducing Admixture: ASTM C 494, Type A.

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2.04 CONNECTION MATERIALS

A. Steel Plates: ASTM A36

B. Anchor Bolts: ASTM A 307.

C. Finish of Steel Units: Exposed units galvanized per ASTM A 153; others painted with rust-inhibitive primer.

D. Bearing Pads: Provide bearing pads for precast concrete units as indicated on drawings.

E. Elastomeric Pads: Vulcanized, chloroprene elastomeric compound, molded to size or cut form a molded sheet, 50-60 shore A durometer.

F. Laminated Fabric-Rubber Pads: Preformed, unused synthetic fibers and new, unvulcanized rubber. Surface hardness of 70-80 shore A durometer.

G. Frictionless Pads: Tetrafluoroethylene (TFE), with glass-fiber reinforcing as required for service load-bearing stress.

H. Tempered Hardboard Pads: Smooth both sides.

I. Welding Electrodes: Comply with AWS standards.

J. Accessories: Provide clips, hangers, and other accessories required for installation of project units.

2.05 GROUT MATERIALS

A. Cement Grout: Portland cement, ASTM C 150, Type I, and clean, natural sand, ASTM C 404.

2.06 PROPORTIONING AND DESIGN OF MIXES

A. Prepare design mixes for each type of concrete required.

B. Proportion mixes by either laboratory trial batch or field experience methods.

C. Produce standard-weight concrete consisting of specified portland cement, aggregates, admixtures, and water to produce the following properties.

1. Compressive strength - 5000psi minimum at 28 days.

2. Release strength for prestressed units - 3500psi.

D. Admixtures

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1. Use air-entraining admixture in concrete.

2. Use water-reducing admixtures in strict compliance with manufacturers directions.

2.07 FABRICATION

A. General: Fabricate precast concrete units complying with manufacturing and testing procedures, quality control recommendations, and dimensional tolerances of PCI MNL-116.

B. All pre-cast concrete products shall be designed to support the dead load indicated on the plans and live loads in accordance with the Governing Building Code and ASCE 7 – Minimum Design Loads for Buildings and Other Structures. Design shall be in accordance with ACI 318 - Building Code Requirements for Reinforced Concrete.

C. All pre-cast concrete design shall be accomplished by, or under the direct supervision of a Professional Engineer registered in the State of Florida, who has had a minimum of two years responsible experience in pre-cast/prestressed concrete design. He shall affix his signature and seal to all design calculations and shop drawings certifying that all precast/prestressed concrete products have been designed to meet this specification and all load criteria shown on the plans. He shall submit complete design calculations to the Architect/Engineer with the shop drawings submittal.

D. Ready-Mix Concrete: Comply with requirements of ASTM C 94.

E. Built-In Anchorages: Accurately position built-in anchorage devices and secure to framework.

F. Coat surfaces of forms with bond-breaking compound before reinforcement is placed. Provide commercial formula form-coating compounds that will not bond with, stain, or adversely affect concrete surfaces, and that will not impair subsequent treatments of concrete surfaces requiring bond or adhesion. Apply in compliance with manufacturer's instructions.

G. Clean reinforcement of loose rust and mill scale, earth and other materials which reduce or destroy bond with concrete.

H. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations.

I. Place reinforcement to obtain at least the minimum coverages for concrete protection.

J. Pretensioning of tendons for prestressed concrete may be accomplished either by single strand tensioning method or multiple-strand tensioning method.

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K. Place concrete in a continuous operation to prevent formation of seams or planes of weakness in precast units, complying with requirements of ACI 304. Thoroughly consolidate place concrete by internal and external vibration without dislocation or damage to reinforcement and built-in items.

L. Identify pick-up points and orientation in structure with permanent markings, complying with markings indicated on final shop drawings. Imprint casting date on each precast unit on a surface that will not show in the finished structure.

M. Delay detensioning of prestressed units until concrete has attained at least 70% of design stress, as established by test cylinders.

N. Finish of Formed Surfaces: See Architectural plans.

2.08 HOLLOW SLAB UNITS

A. Type: Precast prestressed concrete units with open voids running full length of slabs.
B. Furnish units which are free of voids or honeycomb, with straight true edges and surfaces.

C. Provide "Standard Finish" units unless otherwise indicated.

D. Fabrication: Manufacturer units of concrete materials which will provide a minimum 3500psi compressive strength at time of initial prestress and a 28-day compressive strength of 5000psi.

E. Adequately reinforce slab units to resist transporting and handling stresses.

F. Include cast-in weld plates where required for anchorage.

2.09 PRESTRESS JOIST

A. Type: Plant-fabricated, pre-cast concrete units, produced under rigid, factory-inspected process.

B. Furnish units which are free of voids or honeycomb, with straight true edges and surfaces.

C. Provide "Standard Finish" units unless otherwise indicated.

D. Fabrication - Manufacturer units of concrete materials which will provide a minimum 28-day compressive strength of 5000si.

E. Adequately provide additional reinforcement to resist transporting and handling stresses.

F. Include cast-in weld plates where required for anchorage.

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PART 3 - EXECUTION

3.01 INSTALLATION - GENERAL

A. Welding: Perform welding in compliance with AWS D 1.1, including qualification of welders.

B. Powder-Actuated Fasteners: Do not use powder-actuated fasteners for surface attachment of accessory items in precast, prestressed unit unless otherwise accepted by precast manufacturer.

C. Grouting Connections and Joints: After precast concrete units have been placed and secured, grout open spaces at connection and joints.

D. Defective Work: Precast concrete units which do not conform to specified requirements, including strength, tolerances, and finishes, shall be replaced with precast concrete units that meet requirements of this section. Contractor shall also be responsible for cost of corrections to other work affected by or resulting from corrections to precast concrete work.

END OF SECTION 03410

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SECTION 03 48 00 - CONCRETE WALL AND PIER CAPS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Precast concrete wall and pier caps.

B. Precast concrete pier caps.

1.3 REFERENCE STANDARDS

A. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar; 2023.

B. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation; 2019.

C. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2024.

D. ASTM C642 - Standard Test Method for Density, Absorption, and Voids in Hardened Concrete; 2021.

E. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2024.

F. ASTM C33 - Concrete Aggregates

G. ASTM C39 - Concrete Compressive Strength

H. ASTM C595 - Standard Specification for Blended Hydraulic Cements

I. ASTM C666 - Rapid Freeze/Thaw Resistance of Concrete

J. ASTM C979 - Pigments for Integrally Colored Concrete

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements, for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 – Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 – Product Requirements for substitution procedures.

C. Indicate layout, corners, terminals, radius sizes, junctions with dissimilar materials, accessories and setting details.

1.6 QUALITY ASSURANCE

A. Compliance with Regulations: Comply with requirements of state and local building codes and with rules and regulations relating to building accessibility.

B. Qualifications of Manufacturer: Company specializing in manufacture of precast concrete wall cap units with a minimum of 10 continuous years of documented experience.

C. Qualifications of Subcontractor: Subcontractor shall submit evidence of skill and not less than 5 years of experience in this product type.

D. Pre-installation Conference: As directed by the Architect

E. Precast concrete units shall have a compressive strength of 5,000 PSI minimum.

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1. Concrete for Wall Cap units shall be tested frequently to assure that mixes provide units having not less than 5,000 psi compressive strength at 28 days (average test strength not less than 4,500 psi).

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver all materials to the installation site in the manufacturer's original packaging. Packaging shall contain manufacturer's name, customer name, order, identification number, and other related information.

B. Handle and store precast concrete units in accordance with manufacturer's recommendations.

1.8 FIELD CONDITIONS

A. Install mortar, set caps and grout when surface temperature is a minimum of 50 degrees Fahrenheit (10 degrees Celsius) and rising but no greater than 90 degrees Fahrenheit (32.22 degrees Celsius).

B. Do not install mortar, set caps or grout when inclement weather conditions are expected within 48 hours of completion.

1.9 EXTRA MATERIALS

A. Provide extra pieces of size and color, along with accessories specified, at Owner's request.

1.10 WARRANTY

A. Provide warranty covering precast concrete wall cap units against defects in material and workmanship for a period of 5 years. Unusual abuse and neglect are excepted.

B. Ordering: Comply with manufacturer’s ordering instructions and lead time requirements to avoid construction delays.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
   1. Stepstone, LLC: www.stepstoneprecast.com

2.2 MATERIALS

A. Basis of Design Product:
   1. "Sonorastone® Peaked Wall Cap"

B. Precast concrete wall cap unit composition:
   1. Precast concrete: Hand-made, wet-cast of Portland cement conforming to ASTM C 150, Type III, high early strength.
   2. Aggregate:
      a. Conform to ASTM C 33.
      b. Aggregate for exposed aggregate surface: As selected by Architect from Manufacturer's full line of aggregate options.
   3. Integral Color Admixture:
      a. Conform to ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete.
      b. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding

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substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
1) Davis Colors.

c. Integral color shall be throughout entire product. Finish color shall not be added as a face mix.

C. Provide straight end and corner pieces.

D. Weight: 133 lbs/ft3

E. Water absorption: Not more than 6.0 % average, not more than 7.0 % for any individual unit for standard colors.

F. Entrained air average: 6% entrained air, with no individual piece under 5%.

G. Resistance to Freeze-Thaw: Wall cap units will resist 300 freeze thaw cycles in accordance with ASTM C666 Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.

H. Unit size: 16 inches width.
1. Tolerance: Within 1/8” of designated length, width and thickness.

I. Color: As selected by Architect.

J. Finish:
1. Slate, also known as “Sonorastone”

K. Mortar:
1. Portland Cement Mortar that meets or exceeds ANSI A118.4 requirements when mixed with water or a latex admixture, and is designed for installation of large format tile – Pedestrian Installation.

L. Grout that meets or exceeds ANSI A118.7 when mixed with water or a latex admixture.

M. Sealant:
1. Factory Application of Sealant: Factory apply one coat of penetrating sealer to all surfaces of wall cap units. Sealer shall be non-staining, penetrating material, suitable for exterior or interior use, type which does not discolor or darken the surface.
2. Field Application of Sealant:
a. In geographic regions exposed to freeze-thaw conditions field-applied sealing the entire area, including joints, after installation is mandatory.
3. Conform to sealer manufacturer's recommendations for application and maintenance of sealer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine all surfaces.

B. Verify all dimensions of in-place and subsequent construction.

C. Notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work.

D. Do not proceed with the work until unsatisfactory conditions have been corrected.
1. Installation of precast concrete wall caps, and associated construction, constitutes acceptance of the adjacent and underlying construction.

3.2 PREPARATION

A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

B. Ensure all substrates are clean and free of contaminants and have a roughened surface to encourage bonding.

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3.3 SEALANT APPLICATION

A. Field-applied sealer for the prevention of freeze-thaw is optional in mild climates. If precast concrete units are factory sealed, test for compatibility before applying additional sealer.

B. In geographic regions exposed to freeze-thaw conditions field-applied sealing the entire area, including joints, after installation is mandatory in order to maintain Manufacturer's Warranty.

C. Follow sealer manufacturer’s instructions for application and maintenance of the sealer.

3.4 PROTECTION AND CLEANING

A. Clean exposed surfaces of precast concrete units. Use cleaners appropriate for precast concrete finishes and colors. Acid based cleaners will permanently alter finish and color.

B. Protect precast concrete units from damage due to subsequent building operations.

C. After installation and before completion, inspect precast concrete units for construction damage and obtain new precast concrete units if required.

D. Immediately prior to final acceptance of project, clean precast concrete units.

END OF SECTION

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SECTION 04 01 00 - MAINTENANCE OF MASONRY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Water cleaning of masonry surfaces.

B. Repointing mortar joints.

C. Repair of damaged masonry.

1.2 REFERENCE STANDARDS

A. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2022, with Errata (2024).

A. ACI SPEC-548.14 - Specification for Repairing Concrete with Epoxy Mortar; 2014.

B. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete; 2020a.

1.3 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week prior to commencing work of this section.
   1. Require attendance of parties directly affecting work of this section.
   2. Review conditions of installation, installation procedures, and coordination with related work.

B. Scheduling:
   1. Perform cleaning and washing of masonry with Owner..

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 – Administrative Requirements for submittal requirements.

B. Refer to Section 01 60 00.0 – Product Requirements for substitution procedures.

C. Product Data: Provide data on cleaning compounds.

D. Product Data : For all masonry products.

E. Manufacturer's Instructions: For cleaning materials, indicate special procedures, conditions requiring special attention.

1.6 MOCK-UPS

A. Restore and repoint an existing masonry wall area sized 8 feet (2.40 m) long by 6 feet (2 m) high; include in mock-up area instances of mortar, accessories, wall openings, and flashings.

B. Clean a 10 ft (3 m) by 10 ft (3 m) panel of wall to determine extent of cleaning.
   1. Repeat, using different cleaning methods for up to three different panels.

C. Locate where directed.

D. Acceptable panel and procedures employed will become the standard for work of this section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver masonry neatly stacked and tied on pallets. Store clear of ground with adequate waterproof covering.

1.8 FIELD CONDITIONS - MASONRY WORK

A. Cold and Hot Weather Requirements: Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

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B. Maintain materials and surrounding air temperature to minimum 40 degrees F (5 degrees C) prior to, during, and 48 hours after completion of masonry work.

C. Maintain materials and surrounding air temperature to maximum 90 degrees F (32 degrees C) prior to, during, and 48 hours after completion of masonry work.

PART 2 PRODUCTS

2.1 CLEANING MATERIALS

A. Cleaning Agent: Detergent type.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces to be cleaned are ready for work of this section.

3.2 PREPARATION

A. Protect surrounding elements from damage due to restoration procedures.

B. Carefully remove and store removable items located in areas to be restored, including fixtures, fittings, finish hardware, and accessories; reinstall upon completion.

C. Separate areas to be protected from restoration areas using means adequate to prevent damage.

D. Cover existing landscaping with tarpaulins or similar covers.

E. Mask immediately adjacent surfaces with material that will withstand cleaning and restoration procedures.

F. Close off adjacent occupied areas with dust proof and weatherproof partitions.

G. Protect roof membrane and flashings from damage with 1/2 inch (13 mm) plywood laid on roof surfaces over full extent of work area and traffic route.

H. When using cleaning methods that involve water or other liquids, install drainage devices to prevent runoff over adjacent surfaces unless those surfaces are impervious to damage from runoff.

I. Do not allow cleaning runoff to drain into sanitary or storm sewers.

3.3 REPOINTING

A. Perform repointing prior to cleaning masonry surfaces.

B. Cut out loose or disintegrated mortar in joints to minimum 1/2 inch (6 mm) depth or until sound mortar is reached.

C. Use power tools only after test cuts determine no damage to masonry units will result.

D. Do not damage masonry units.

E. When cutting is complete, remove dust and loose material by brushing.

F. Premoisten joint and apply mortar. Pack tightly in maximum 1/4 inch (6 mm) layers. Form a smooth, compact concave joint to match existing.

G. Moist cure for 72 hours.

3.4 CLEANING EXISTING MASONRY

A. Cleaning Detergent: Brush clean masonry surfaces at select locations with cleaning agent in accordance with the manufacturer's instructions. Saturate masonry with clean water and flush loose mortar and dirt.

3.5 CLEANING NEW MASONRY

A. Verify mortar is fully set and cured.

B. Clean surfaces and remove large particles with wood scrapers, brass or nylon wire brushes.

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C. Scrub walls with cleaning agent solution using stiff brush. Thoroughly rinse and wash off cleaning solution, dirt and mortar crumbs using clean, pressurized water.

D. Use acid solution mixed with water in accordance with manufacturer's instructions. Apply acid solution and scrub masonry with stiff fiber brushes. Do not scrub the mortar joints.

E. Protect area below cleaning operation and keep masonry soaked with water and flushed free of acid and dissolved mortar continuously for duration of cleaning.

F. Before solution dries, rinse and remove acid solution and dissolved mortar, using clean, pressurized water.

3.6 RESTORATION CLEANING

A. Clean surfaces and remove large particles with wood scrapers or non-ferrous wire brush.

B. Spray coat masonry with restoration cleaner, mixed into solution in accordance with manufacturer's instructions.

C. Provide a second application if required to match mock-up area.

D. Allow sufficient time for solution to remain on masonry and agitate with soft fiber brush or sponge.

E. Rinse from the bottom up with potable water applied at 400 psi (2 750 kPa) and at a rate of 4 gal/min (16 L/min).

3.7 AGING

A. Rub in new masonry work to match, as close as possible, adjacent original work.
   1. Use carbon black in small amounts, rubbing in well with burlap rags.

B. After each application, dust off surplus and wash down with low pressure hose. Allow surface to dry before proceeding with succeeding applications.

C. Continue process until acceptance.

3.8 CLEANING

A. Immediately remove stains, efflorescence, or other excess resulting from the work of this section.

B. Remove excess mortar, smears, and droppings as work proceeds and upon completion.

C. Clean surrounding surfaces.

END OF SECTION

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SECTION 04 10 24 - MASONRY REPAIR

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INLCUDES

A. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Repairing voids in masonry.

1.3 REFERENCE STANDARDS

A. ASTM C67 – Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.

B. ASTM C90 – Standard Specification for Loadbearing Concrete Masonry Units.

C. ASTM C144 – Standard Specification for Aggregate for Masonry Mortar.

D. ASTM C150 – Standard Specification for Portland Cement.

E. ASTM C207 – Standard Specification for Hydrated Lime for Masonry Purposes.

F. ASTM C216 – Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale)

G. ASTM C1392/C1392M – Standard Specification for Mortar Cement.

1.4 REFERENCES:

A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 – Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 – Product Requirements for substitution procedures.

C. Product Data: For each type of product.
   1. Include recommendations for product application and use. Include test data substantiating that products comply with requirements.

1.6 QUALITY ASSURANCE

A. Mockups: Prepare mockups of masonry repair to demonstrate aesthetic effects and to set quality standards for materials and execution and for fabrication and installation.
   1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver packaged materials to Project site in manufacturer's original and unopened containers, labeled with manufacturer's name and type of products.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit masonry repair work to be performed according to product manufacturers' written instructions and specified requirements.

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PART 2 PRODUCTS

2.1 MASONRY UNITS

A. Shapes: Provide shapes with exposed surfaces matching existing exposed faces of adjacent units.

B. CMUs: ASTM C 90.
   1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi.
   2. Density Classification: Normal weight.
   3. Size and Shape: Match existing.
   4. Exposed Faces: Provide texture matching existing.

2.2 MORTAR MATERIALS

A. Mortar Cement: ASTM C 1329/C 1329M.

B. Mortar Sand: ASTM C 144.
   1. Exposed Mortar: Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands if necessary to achieve suitable match.

C. Water: Potable.

2.3 MORTAR MIXES

A. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer.

B. Do not use admixtures in mortar unless otherwise indicated.

PART 3 EXECUTION

3.1 MASONRY REPAIR, GENERAL

A. Appearance Standard: Repaired surfaces are to have a uniform appearance as viewed from 20 feet away by Architect.

3.2 MASONRY INSTALLATION REPLACEMENT

A. Install masonry into bonding and coursing pattern of existing masonry. If cutting is required, use a motor-driven saw designed to cut masonry with clean, sharp, unchipped edges.
   1. Maintain joint width for replacement units to match existing joints.
   2. Use setting buttons or shims to set units accurately spaced with uniform joints.

B. Lay replacement masonry with rebuilding (setting) mortar and with completely filled bed, head, and collar joints. Butter ends with enough mortar to fill head joints and shove into place. Wet both replacement and surrounding masonry.
   1. Tool exposed mortar joints in repaired areas to match joints of surrounding existing masonry.

3.3 MASONRY UNIT PATCHING

A. Patch the following masonry units:
   1. Patch masonry units with voids and holes.
   2. Remove loose material from masonry surface. Carefully remove additional material so patch does not have feathered edges but has square or slightly undercut edges on area to be patched and is at least 1/4 inch thick, but not less than recommended by patching compound manufacturer.
   3. Rinse surface to be patched and leave damp, but without standing water.
   4. Brush-coat surfaces with slurry coat of mortar compound.
   5. Place mortar compound in layers, but not less than 1/4 inch or more than 2 inches thick. Roughen surface of each layer to provide a key for next layer.

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6. Trowel, scrape, or carve surface of patch to match texture and surrounding surface plane of masonry unit. Shape and finish surface before or after curing, as determined by testing, to best match existing masonry unit.
7. Keep each layer damp for 72 hours or until patching compound has set.

3.4 FINAL CLEANING

A. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water applied by low-pressure spray.
   1. Do not use metal scrapers or brushes.
   2. Do not use acidic or alkaline cleaners.

B. Clean adjacent non-masonry surfaces. Use detergent and soft brushes or cloths.

C. Clean mortar and debris from roof; remove debris from gutters and downspouts. Rinse off roof and flush gutters and downspouts.

D. Remove masking materials, leaving no residues that could trap dirt.

END OF SECTION

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SECTION 04 20 00
UNIT MASONRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.02 QUALITY ASSURANCE

A. Codes and Standards: Comply with governing codes and applicable provisions of the following:

1. National Concrete Masonry Association (NCMA), including "TEK Bulletins".

2. American Concrete Institute (ACI), including ACI 531, ACI 531R and ACI 531.1.

3. Portland Cement Association (PCA), "Concrete Masonry Handbook".

B. Fire Performance Characteristics: Where fire-resistance ratings are indicated for unit masonry work, provide materials and construction which are identical to those of assemblies whose fire endurance has been determined by testing in compliance with ASTM E 119 by a recognized testing and inspecting organization or by another means, as acceptable to authority having jurisdiction.

C. Field Construction Mock-Ups: Prior to installation of masonry work, erect sample wall representative of completed masonry work required for project with respect to qualities of appearance, materials and construction. Locate mock-ups during construction as standard for judging completed masonry work. Build mock-ups which are approximately 6' long by 4' high by full thickness. When directed, demolish mock-ups and remove from site.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's product data for each type of masonry unit, accessory and other manufactured products, including certifications that each type complies with specified requirements.

1.04 JOB CONDITIONS

A. Protection of Work: During erection, cover top of walls with waterproof sheeting at end of each day's work. Cover partially completed structures when work is not in progress.

B. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

C. Do not apply uniform floor or roof loading for at least 12 hours after building masonry walls or columns.

D. Do not apply concentrated loads for at least 3 days after building masonry walls or columns.

E. Staining: Prevent grout or mortar or soil from staining the face of masonry to be left exposed or painted. Remove immediately grout or mortar in contact with such masonry. Protect base of

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walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over all surface.

F. Protect sills, ledges and projections from droppings of mortar.

G. Cold Weather Protection

1. Do not lay masonry units which are wet or frozen.

2. Remove all masonry determined to be damaged by freezing conditions.

3. No masonry work shall be performed when the air temperature is 38 deg. F. and falling.

PART 2 - PRODUCTS

2.01 MASONRY UNITS - GENERAL

A. Manufacturer: Obtain masonry units from one manufacturer, of uniform texture and color for each kind required, for each continuous area and visually related areas.

B. Masonry Unit Characteristics: Provide units complying with standards referenced and requirements indicated.

2.02 CONCRETE MASONRY UNITS (CMU)

A. Size: Manufacturer's standard units with nominal face dimensions of 16" long x 8" (15-5/8" x 7-5/8" actual), unless otherwise indicated.

B. Special Shapes: Provide where required for lintels, corners, jambs, sash, control joints, headers, bonding and other special conditions.

C. Hollow Load Bearing (HL) CMU: ASTM C 90 and as follows:

1. Grade N.

D. Weight Classification: Normal weight units unless otherwise indicated. (125 lbs. per cu. ft. or more, oven dry weight of concrete.)

E. Cure units by atmospheric drying for not less than 30 days before installation, to comply with ASTM C 90, Type II.

F. Exposed Faces: Provide manufacturer's standard color and texture, unless otherwise indicated.

1. Where special finishes are indicated, provide units with exposed faces of the following general description matching color and texture as selected by Architect from manufacturers standard color and texture.

a. Standard aggregate, ground finish.

b. Standard aggregate, split face finish.

G. Prefaced Concrete Block: Provide lightweight concrete units indicated below with manufacturer's standard smooth resinous tile facing complying with ASTM C744:

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1. For units on which prefaced surfaces are molded, comply with the following requirements:

   a. Hollow Loadbearing Block: ASTM C90, Grade N, Type I.

2. Size: Manufacturer's standard with nominal face dimensions of 16" long x 8" high (15-5/8" x 7-5/8" actual) x thickness indicated for units on which prefaced surfaces are molded; with 1/16" thick returns of facing to create 1/4" wide mortar joints with modular coursing.

I. Color and Pattern: Match Architect's sample.

J. Products: Subject to compliance with requirements, provide one of the following:

1. "Astra-Glaze"; Nabco Glazed Products.

2. "Spectra-Glaze II"; manufacturer approved by the Burns & Russell Co.

2.03 MORTAR MATERIALS

A. Portland Cement: ASTM C 150, Type I, except Type III may be used for cold weather construction. Provide natural color or white cement as required to produce required mortar color.

B. Masonry Cement: ASTM C 91.

C. Hydrated Lime: ASTM C 207, Type S.

D. Aggregate for Mortar: ASTM C 144, except for joints less than 1/4" use aggregate graded with 100% passing the No. 16 sieve.

E. Aggregate for Grout: ASTM C 404.

F. Water: Clean and potable.

2.04 MASONRY ACCESSORIES

A. Horizontal Joint Reinforcing and Ties for Masonry: Provide welded wire units prefabricated in straight lengths of not less than 10', with matching corner ("L") and intersecting ("T") units. Fabricate from cold-drawn steel wire complying with ASTM A 82, with deformed continuous side rods and plain cross rods, into units with widths of approximately 2" less than nominal width of walls and partitions as required to position side rods for full embedment in mortar with mortar coverage of not less than 5/8" on joint faces exposed to exterior and not less than 1/2" elsewhere. Provide the following type of joint reinforcing unless otherwise indicated.

1. Truss type with diagonal cross rods spaced not more than 16" o.c.

B. Number of Side Rods: Single pair for single wythe masonry.

C. Wire Sizes: Fabricate with 9-gage side and cross rods, unless otherwise indicated.

D. Wire Finish: Provide manufacturer's standard mill galvanized finish except as otherwise indicated.

E. For exterior walls hot-dip galvanized joint reinforcing after fabrication to comply with ASTM A 153, Class B-2 coating (1.5 oz. per sq. ft.).

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F. Steel Strap Anchors: Provide straps, bars, bolts and rods fabricated from not less than 16 ga. sheet metal or 3/8" diameter rod stock, unless otherwise indicated.

G. Miscellaneous Masonry Accessories

1. Reinforcing Bars: Deformed steel, ASTM A 615, Grade 60 for bars No. 3 to No. 18.

2.05 MORTAR AND GROUT MIXES

A. Do not lower the freezing point of mortar by use of admixtures or anti-freeze agents.

B. Do not use calcium chloride in mortar or grout.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification, for types of mortar required, unless otherwise indicated.

D. Limit cementitious materials in mortar to portland cement - lime.

E. Use Type N mortar for all interior masonry work.

F. Use Type S mortar for all exterior masonry work.

G. Grout for Unit Masonry: Comply with ASTM C 476 for grout for use in construction of unit masonry. Use grout of consistency indicated or if not otherwise indicated, of consistency (fine or coarse) at time of placement which will completely fill all spaces intended to receive grout.

PART 3 - EXECUTION

3.01 INSTALLATION - GENERAL

A. Thickness: Build masonry construction to the full thickness shown, except, build single-wythe walls (if any) to the actual thickness of the masonry units, using units of nominal thickness shown or specified.

B. Build chases and recesses as shown and as required for the work of other trades. Provide not less than 8" of masonry between chase or recess and jamb of openings, and between adjacent chases and recesses unless otherwise noted.

C. Cut masonry units with motor-driven saw designed to cut masonry with clean, sharp, unchipped edges. Cut units as required to provide pattern shown and to fit adjoining work neatly. Use full units without cutting wherever possible. Use dry cutting saws to cut concrete masonry units.

D. Do not wet concrete masonry units.

E. Pattern Bond: Lay exposed masonry in running bond vertical joint in each course centered on units in courses above and below except as otherwise noted.

F. Layout walls in advance for accurate spacing of surface bond patterns with uniform joint widths and to properly locate openings, movement-type joints, returns and offsets. Avoid the use of less-than-half size units at corners, jambs and wherever possible at other locations.

G. Lay-up walls plumb and with courses level, accurately spaced and coordinated with other work.

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H. Stopping and Resuming Work: Rack back 1/2-masonry unit length in each course; do not tooth. Clean exposed surfaces of set masonry, wet units lightly (if required to be wetted), and remove loose masonry units and mortar prior to laying fresh masonry.

I. Built-In Work: As the work progresses, build-in items specified under this and other sections of these specifications. Fill in solidly with masonry around built-in items.

J. Fill space between hollow metal frames and masonry solidly with mortar.

K. Where built-in items are to be embedded in cores of hollow masonry units, place a layer metal lath in the joint below and rod mortar or grout into core.

L. Fill CMU cores with grout 3 courses (24") under bearing plates, beams, lintels, posts and similar conditions unless otherwise indicated.

M. Non-Loadbearing Interior Partition Walls: Build full height of story to underside of solid structure above, unless otherwise indicated.

3.02 MORTAR BEDDING AND JOINTING

A. Lay hollow concrete masonry units will full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting course on footings and foundation walls and in all courses of piers, columns and pilasters, and where adjacent to cells or cavities to be reinforced or to be filled with concrete or grout. For starting courses on footings where cells are not grouted, spread out full mortar bed including areas under cells.

B. Joints: Maintain joint widths shown, except for minor variations required to maintain bond alignment. If not otherwise indicated, lay walls with 3/8" joints. Cut joints flush for masonry walls which are to be concealed or to be covered by other materials. Tool all exposed joints in masonry walls slightly concave using a jointer larger than joint thickness. Rake out mortar in preparation for application of caulking or sealants where shown.

C. Remove masonry units disturbed after laying; clean and relay in fresh mortar. Do not pound corners at jambs to fit stretcher units which have been set in position. If adjustments are required, remove units, clean off mortar, and reset in fresh mortar.

3.03 HORIZONTAL JOINT REINFORCING

A. Provide continuous horizontal joint reinforcing as shown and specified. Full embed longitudinal side rods in mortar for their entire length with a minimum cover of 5/8" on exterior side of walls and 1/2" at other locations. Lap reinforcement a minimum of 6". Do not bridge control and expansion joints with reinforcing, unless otherwise indicated. Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections. Cut and bend units as directed by manufacturer for continuity at returns, offsets, pipe enclosures and other special conditions.

B. Space conditions horizontal reinforcing as follows:

1. For single wythe walls, space reinforcing at 16" o.c. vertically, unless otherwise indicated.
2. Reinforce masonry openings greater than 1'-0" wide, with horizontal joint reinforcing placed in 2 horizontal joints approximately 8" apart, both immediately above lintels and below sills.

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3. Extend reinforcing a minimum of 2'-0" beyond jambs of the opening, bridging control joints where provided.

3.04 ANCHORING MASONRY WORK

A. See Drawings.

3.05 LINTELS

A. Provide masonry lintels where shown and wherever openings of more than 1'-0" are shown without structural steel or other supporting lintels. Provide precast or formed in place lintels. Cure precast masonry before handling or installing. Temporarily support formed-in-place lintels.

B. Provide minimum bearing of 8" at each jamb, unless otherwise indicated.

3.06 REPAIR, POINTING AND CLEANING

A. Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point-up all joints at corners, openings and adjacent work to provide a neat, uniform appearance, properly prepared for application of caulking or sealant compounds.

C. Clean exposed CMU masonry by dry brushing at the end of each day's work and after final pointing to remove mortar spots and droppings. Comply with recommendations in NCMA TEK Bulletin No. 28.

END OF SECTION 04 20 00

SECTION 04 20 30
REINFORCED UNIT MASONRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Special Conditions and Division 1 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK

A. Provide each type of reinforced unit masonry work as indicated on drawings and in schedules and specified herein.

B. Requirements of Section 04 20 00, "Unit Masonry" apply to work of this section.

1.03 SUBMITTALS

A. Shop Drawings: Submit shop drawings for fabrication, bending, and placement of reinforcement bars. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures". Show bar schedules, diagrams of bent bars, stirrup spacing, lateral ties and other arrangements and assemblies as required for fabrication and placement of reinforcement for unit masonry work.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Refer to Section 04 20 00 for masonry materials and accessories not included in this section.

B. Reinforcement Bars: Provide deformed bars of Grade 60 complying with ASTM A 615.

C. Shop-fabricate reinforcement bars which are shown to be bent or hooked.

PART 3 - EXECUTION

3.01 PLACING REINFORCEMENT

A. General: Clean reinforcement of loose rust, mill scale, earth, ice or other materials which will reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on drawings or final shop drawings, or bars with reduced cross-section due to excessive rusting or other causes.

B. Position reinforcement accurately at the spacing indicated. Support and secure vertical bars against displacement. Horizontal reinforcement may be placed as the masonry work progresses. Where vertical bars are shown in close proximity, provide a clear distance between bars of not less than the nominal bar diameter or 1" (whichever is greater).

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C. Splice reinforcement bars where shown; do not splice at other points unless acceptable to the Architect. Provide lapped splices, unless otherwise indicated. In splicing vertical bars or attaching to dowels, lap ends, place in contact and wire tie.

D. Embed prefabricated horizontal joint reinforcement as the work progresses, with a minimum cover of 5/8" on exterior face of walls and 1/2" at other locations. Lap units not less than 6" at ends. Use prefabricated "L" and "T" units to provide continuity at corners and intersections. Cut and bend units as recommended by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.

3.02 INSTALLATION - GENERAL

A. Refer to Section 04 20 00 for general installation requirements of unit masonry.

3.03 INSTALLATION OF REINFORCED CONCRETE UNIT MASONRY

A. General

1. Do not wet concrete masonry units (CMU).

2. Lay CMU units with full-face shell mortar beds. Fill vertical head joints (end joints between units) solidly with mortar from face of unit to a distance behind face equal to not less than the thickness of longitudinal face shells. Solidly bed cross-webs of starting courses in mortar. Maintain head and bed joint widths shown, or if not shown, provide 3/8" joints.

B. Walls

1. Pattern Bond: Lay CMU wall units in 1/2 running bond with vertical joints in each course centered on units in courses above and below, unless otherwise indicated. Bond and interlock each course at corners and intersections. Use special-shaped units where shown, and as required for corners, jambs, sash, control joints, lintels, bond beams and other special conditions.

2. Maintain vertical continuity of core or cell cavities, which are to be reinforced and grouted, to provide minimum clear dimensions indicated and to provide minimum clearance and grout coverage for vertical reinforcement bars. Keep cavities free of mortar. Solidly bed webs in mortar where adjacent to reinforced cores or cells.

3. Where horizontal reinforced beams (bond beams) are shown, use special units or modify regular units to allow for placement of continuous horizontal reinforcement bars. Place small mesh expanded metal lath or wire screening in mortar joints under bond beam courses over cores or cells on non-reinforced vertical cells, or provide units with solid bottoms.

C. Grouting

1. Use "Fine Grout" per ASTM C 476 for filling spaces less than 4" in one or both horizontal directions.

2. Use "Course Grout" per ASTM C476 for filling 4" spaces or larger in both horizontal directions.

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D. Low-Lift Grouting

1. Provide minimum clear dimension of 2" and clear area of 8 sq. in. in vertical cores to be grouted.

2. Place vertical reinforcement prior to laying of CMU. Extend above elevation of maximum pour height as required for splicing. Support in position at vertical intervals not exceeding 192 bar diameters nor 10 ft.

3. Lay CMU to maximum pour height. Do not exceed 5' height, or if bond beam occurs below 5' height stop pour at course below bond beam.

4. Pour grout using chute or container with spout. Rod or vibrate grout during placing. Place grout continuously; do not interrupt pouring of grout for more than one hour. Terminate grout pours 1-1/2" below top course of pour.

5. Bond Beams - Stop grout in vertical cells 1-1/2" below bond beam course. Place horizontal reinforcement in bond beams; lap at corners and intersections as shown. Place grout in bond beam course before filling vertical cores above bond beam.

END OF SECTION 04 20 30

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SECTION 04 21 13 - BRICK MASONRY VENEER

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Face brick (ST-01, ST-02, ST-03).
   2. Mortar and grout.
   3. Joint reinforcing, ties, and anchors.
   4. Miscellaneous masonry accessories.
   5. Installation of steel lintels and shelf angles.

1.3 REFERENCE STANDARDS

A. ASCE 5 - Building Code Requirements and Specification for Masonry Structures; 2011.

B. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2026.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

D. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement; 2022.

E. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction; 2022.

F. ASTM C91/C91M - Standard Specification for Masonry Cement; 2025.

G. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 50 mm [2 in.] Cube Specimens); 2024.

H. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2024.

I. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2024.

J. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale); 2026.

K. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2025.

L. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.

M. ASTM C780 - Standard Test Methods for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2025.

N. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).

O. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2024.

P. ASTM C1019 - Standard Test Method for Sampling and Testing Grout for Masonry; 2024a.

Q. ASTM C1329/C1329M - Standard Specification for Mortar Cement; current edition.

R. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016 (Reapproved 2021).

S. ASTM D638 - Standard Test Method for Tensile Properties of Plastics; 2022.

T. ASTM D1056 - Standard Specification for Flexible Cellular Materials—Sponge or Expanded Rubber; 2020.

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U. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015 (Reapproved 2021).

V. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

W. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.

X. ASTM A82 – Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

Y. ASTM A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

Z. ASTM A167 – Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

AA. ASTM A366 – Standard Specification for Commercial Steel (CS) Sheet, Carbon (0.15 Maximum Percent) Cold Rolled.

BB. ASTM A510 – Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel.

CC. ASTM A951 – Standard Specification for Steel Wire for Masonry Joint Reinforcement.

DD. ASTM A580 – Standard Specification for Stainless Steel Wire.

EE. ASTM C67 – Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.

FF. ASTM C150 – Standard Specification for Portland Cement.

GG. ACI 530.1 /ASCE 6/TMS 602 – Specifications for Masonry Structures.

HH. National Concrete Masonry Association (NCMA), including “TEK Bulletins.”

II. Portland Cement Association (PCA), “Concrete Masonry Handbook.”

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements, for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 - Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 - Product Requirements for substitution procedures.

C. Product Data: For each type of product indicated.

D. Shop Drawings: For the following:
   1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
   2. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

E. Samples for Initial Selection:
   1. Face brick.
   2. Masonry accessories.
   3. Cavity drainage material.
   4. Colored mortar.
   5. Weeps/vents.

F. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
   1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C109/C109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
   2. Include test reports, according to ASTM C1019, for grout mixes required to comply with compressive strength requirement.

G. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.
   1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

H. Material Certificates: For each type and size of the following:
   1. Masonry units.
      a. Include data on material properties.
      b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
      c. For exposed brick, include test report for efflorescence according to ASTM C 67.
   2. Cementitious materials. Include brand, type, and name of manufacturer.
   3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
   4. Grout mixes. Include description of type and proportions of ingredients.
   5. Anchors, ties, and metal accessories.

1.6 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Provide products from a firm that makes the indicated products as a regular production item and with not less than ten (10) years experience.

B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation of specified materials and assemblies with not less than five (5) years experience.

C. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

D. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

E. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
   1. Extend cover a minimum of 24 inches (609.6 mm) down both sides of walls and hold cover securely in place.
   2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches (609.6 mm) down face next to unconstructed wythe and hold cover in place.

1.7 PERFORMANCE REQUIREMENTS

A. Standards: Comply with the most recent edition of the following:
   1. National Concrete Masonry Association (NCMA), including “TEK Bulletins.”
   2. American Concrete Institute (ACI), ACI 530/ASCE 5/TMS; and ACI 530.1/ASCE 6.
   3. Portland Cement Association (PCA), “Concrete Masonry Handbook.”

1.8 MOCKUPS

A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

B. Build mockups for typical exterior wall in sizes approximately 8' high with a right angle corner with a 6' and a 4' leg by full thickness, including face and backup wythes and accessories.
   1. Include a sealant-filled joint at least 16 inches (406.4 mm) long in exterior wall mockup.
   2. Include lower corner of window opening in exterior wall mockup.

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3. Include precast concrete one-piece window sill.
4. Include through-wall flashing installed for a 24-inch length in corner of exterior wall mockup approximately 16 inches (406.4 mm) down from top of mockup, with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).
5. Include water-resistive barrier, veneer anchors, flashing, cavity drainage material, and weep holes in exterior masonry-veneer wall mockup.

C. Clean one-half of exposed faces of mockups with masonry cleaner as indicated.

D. Protect accepted mockups from the elements with weather-resistant membrane.

E. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
1. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

F. Mock-up shall be built separately independent from the structure and shall remain and be maintained during the course of construction.

1.9 PRE-INSTALLATION MEETING

A. The Contractor shall conduct a pre-installation meeting at the project site a minimum of 30 days prior to any work being installed as indicated in this section and other related sections that require coordination with this section.

1.10 PRECONSTRUCTION TESTING SERVICE

A. A qualified independent testing agency shall perform preconstruction testing indicated below. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Testing Prior to Construction: One set of tests.

C. Clay Masonry Unit Test: For each type of unit provided, according to ASTM C 67 for compressive strength.

D. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C780.

E. Mortar Test (Property Specification): For each mix provided, according to ASTM C780. Test mortar for mortar air content and compressive strength.

F. Grout Test (Compressive Strength): For each mix required, according to ASTM C1019.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

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1.12 FIELD CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
   1. Extend cover a minimum of 24 inches (609.6 mm) down both sides of walls and hold cover securely in place.

B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
   1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
   2. Protect sills, ledges, and projections from mortar droppings.
   3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
   4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
   1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 degrees Fahrenheit (4.44 degrees Celsius) and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
   1. Meridian Brick

B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
   1. Belden Brick.
   2. Cherokee Brick and Tile.
   3. Taylor Clay Products.
   4. Oldcastle.
   5. Carolina Ceramics Brick Company.
   6. Endicott Brick.

2.2 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

2.3 FACE BRICK (ST-01, ST-02, ST-03)

A. Provide shapes indicated on Drawings and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units.

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1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing and shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Comply with ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale).

C. Texture(s): As selected by the Architect.

D. Color(s): As selected by the Architect.

E. Grade: SW

F. Type: FBX

G. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested per ASTM C 67.

H. Compressive Strength: Minimum of 3000 psi (20684.28 kPa) for an average of 5 bricks and 2500 psi (17236.90 kPa) minimum for a single brick.

I. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced".

J. Size (Actual Dimensions): Utility – 3 ½" wide x 3 5/8" high x 11 5/8" long.

K. Bond Pattern: Running

L. Special Patterns: Solder course where indicated.

2.4 MORTAR MATERIALS

A. Portland Cement: ASTM C 150, Type I or II.

B. Hydrated Lime: ASTM C207, Type S.

C. Masonry Cement: ASTM C91/C91M

D. Mortar Cement: ASTM C1329/C1329M.

E. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime masonry cement or mortar cement and mortar, all complying with specified requirements, and containing no other ingredients.

F. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in masonry mortar.

G. Colored Cement Product: Packaged blend made from portland cement and hydrated lime masonry cement or mortar cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.
1. Color: As selected by the Architect.

H. Aggregate for Mortar: ASTM C144.
1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch (6.35 mm) thick, use aggregate graded with 100 percent passing the No. 16 sieve.

I. Water: Potable

2.5 REINFORCEMENT

A. Masonry Joint Reinforcement, General: ASTM A951/A951M.
1. Coating: Hot-dip galvanized, carbon steel.
2. Wire Size for Side Rods: 0.148-inch diameter.
3. Wire Size for Cross Rods: 0.148-inch diameter.

4. Wire Size for Veneer Ties: 0.148-inch diameter.
5. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (406.4 mm) o.c.
6. Provide in lengths of not less than 10 feet (304.8 cm), with prefabricated corner and tee units.

B. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

2.6 TIES AND ANCHORS

A. Brick Veneer Anchors, General
1. Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment to backup wall and as follows:
a. Structural Performance Characteristics: Capable of withstanding a 100-lbf load in both tension and compression without deforming or developing play in excess of 0.05 inch (1.27 mm).
b. Tie and Anchors: Provide anchoring systems ties that comply with ACI 530.1/ASCE 6.
c. Material: ASTM A 167 or ASTM A240/A240M sheet metal galvanized to comply with ASTM A653/A653M, G60 coating unless indicated otherwise.

B. Substrate Anchors
1. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
a. Hohmann & Barnard, Inc.
b. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
1) Dayton Superior Corporation, Dur-O-Wal Division;
2) Heckmann Building Products, Inc.
2. Brick Veneer Adjustable Anchors with Masonry or Concrete Backup Wall:
a. Basis of Design Product: “HB-213-2X Adjustable Veneer Anchor” units consisting of a wire tie and a metal anchor section.
3. Brick Veneer Anchor with Masonry Backup Wall:
a. Basis of Design Product: “Hook and Eye Tie System #270–2X” in size as required to comply with required joint embed criteria.

2.7 EXPANSION JOINTS

A. General: Install expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span expansion joints without provision to allow for in-plane wall or partition movement.

B. Form expansion joints with open joint full depth of brick wythe with a 3/8” for installation of sealant and backer rod specified in specification section "Joint Sealants."

C. Provide horizontal, pressure-relieving joints by either leaving an airspace or inserting a compressible filler of width required for installing sealant and backer rod specified in specifications section "Joint Sealants," but not less than 3/8 inch (9.52 mm) nor more than 5/8". Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

2.8 INSULATION

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.

1. Dow Chemical Company.
    a. Basis of Design Product: “Styrofoam Cavitymate Plus”

B. Extruded Polystyrene Board: Unfaced, ASTM C578, 25 psi (172.37 kPa) minimum compressive strength with maximum flame-spread of 75 and smoke-developed indexes of 450, respectively, per ASTM E84.
1. Minimum R-Value: 5.0 per inch of thickness.
2. Size: 15 3/4” X 96”
3. Thickness: Total thickness shall be 2" or as indicated on drawings.

2.9 ACCESSORIES

A. Compressible Filler: Pre-molded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane, or PVC.

B. Preformed Control-Joint Gaskets: Closed cell neoprene/SBR with pressure sensitive adhesive on one side.
1. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
    a. Hohmann & Barnard, Inc.
        1) Basis of Design Product: “NS - Closed Cell Neoprene Sponge”

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

D. Metal flashing: Copper comply with ASTM B370, Temper H00, cold-rolled copper sheet, 0.0216 inch (0.55 mm) thick or ASTM B370, Temper H01, high-yield copper sheet 0.0162 inch (0.41 mm) thick. Fabricate continuous flashings in sections 96 inches (2438.4 mm) long minimum, but not exceeding 12 feet (365.76 cm). Provide splice plates at joints of formed, smooth metal flashing.

E. Through Wall Flashing: Composite 40-mil thick membrane with clear asphalt-free adhesive.
1. Basis of Design: “Textroflash Flashing” as manufactured by Hohmann & Barnard, Inc. Equal or better performing products of other manufacturers will be considered for acceptance by the Architect.

F. Weep/Vents: Honeycomb design formed from polypropylene complying with ASTM D2240, ASTM D790B, ASTM D638 and ASTM D1238B.
1. Basis of Design: “Quadro-Vent” as manufactured by Hohmann & Barnard, Inc. Equal or better performing products of other manufacturers will be considered for acceptance by the Architect.
2. Size: Vent shall match brick size.

2.10 DRAINAGE MATS

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
1. Hohmann & Barnard, Inc.
    a. Basis of Design Product: “Mortar Trap”

B. Cavity Drainage Mat Material: Free-draining mesh, fabricated from high-density polyrthylene (HDPE).

C. Mats: Mats shall be of a thickness to equal the size of the cavity air space.

2.11 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

B. Job-Mixed Detergent Solution: Solution of 1/2 cup dry measure tetrasodium polyphosphate and 1/2 cup dry measure laundry detergent dissolved in 1 gallon of water.

2.12 MORTAR MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
   1. Do not use calcium chloride in mortar.
   2. Add cold-weather admixture (if used) at the same rate for all mortar, regardless of weather conditions, to ensure that mortar color is consistent.

B. Pre-blended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a pre-blended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Provide Type N unless another type is indicated.

D. Pigmented Mortar: Use colored cement product. Do not add pigments to colored cement products.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF FLUID-APPLIED MEMBRANE AIR BARRIER

A. General: Install and use accessory materials according to Specification Section – Fluid-Applied Membrane Air Barrier.

3.3 INSTALLATION OF INSULATION

A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches (609.6 mm) o.c. both ways on inside face and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.

3.4 INSTALLATION OF FACE BRICK, GENERAL

A. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

B. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

C. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
   1. Mix units from several pallets or cubes as they are placed.

D. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

3.5 TOLERANCES

A. Dimensions and Locations of Elements:
   1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch (12.7 mm) or minus 1/4 inch (6.35 mm).
   2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch (12.7 mm).
   3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch (6.35 mm) in a story height or 1/2 inch (12.7 mm) total.

B. Lines and Levels:
   1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch (6.35 mm) in 10 feet (304.8 cm), or 1/2 inch (12.7 mm) maximum.
   2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch (3.18 mm) in 10 feet (304.8 cm), 1/4 inch (6.35 mm) in 20 feet (609.6 cm), or 1/2 inch (12.7 mm) maximum.
   3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch (6.35 mm) in 10 feet (304.8 cm), 3/8 inch (9.52 mm) in 20 feet (609.6 cm), or 1/2 inch (12.7 mm) maximum.
   4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch (3.18 mm) in 10 feet (304.8 cm), 1/4 inch (6.35 mm) in 20 feet (609.6 cm), or 1/2 inch (12.7 mm) maximum.
   5. For lines and surfaces do not vary from straight by more than 1/4 inch (6.35 mm) in 10 feet (304.8 cm), 3/8 inch (9.52 mm) in 20 feet (609.6 cm), or 1/2 inch (12.7 mm) maximum.
   6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch (6.35 mm) in 10 feet (304.8 cm), or 1/2 inch (12.7 mm) maximum.
   7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch (1.59 mm) except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:
   1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3.18 mm), with a maximum thickness limited to 1/2 inch (12.7 mm); do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
   2. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3.18 mm).
   3. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch (1.59 mm) from one masonry unit to the next.

3.6 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in bond indicated, unless a special bond pattern is indicated on Drawings; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

C. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

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3.7 MORTAR BEDDING AND JOINTING

A. Lay hollow brick with entire units, including areas under cells, fully bedded in mortar at starting course on footings.

B. Tool exposed joints.

3.8 ANCHORING MASONRY VENEERS

A. Anchor masonry veneers to backup wall with veneer anchors to provide not less than 2 inches (50.8 mm) of air space or as indicated on the drawings and comply with the following requirements:
   1. Concrete Wall Backup: Fasten screw-attached anchors to masonry or concrete with metal fasteners of type indicated where embed tie installation is not possible.
   2. Masonry Wall Backup: Embed tie sections in masonry joints.
   3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
   4. Space anchors as indicated, but not more than 16 inches (406.4 mm) o.c. vertically and 24 inches (609.6 mm) o.c. horizontally, with not less than 1 anchor for each 2.67 sq. ft. of wall area. Install additional anchors within 12 inches (304.8 mm) of openings and at intervals, not exceeding 8 inches (203.2 mm), around perimeter.

B. Fasten screw-attached anchors to masonry with metal fasteners of type indicated.

C. Embed tie sections in masonry joints. Provide not less than 2 inches (50.8 mm) of air space between back of masonry veneer and face of sheathing.

D. Locate anchor sections to allow maximum vertical differential movement of ties up and down.

3.9 EXPANSION JOINTS

A. General: Install expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span expansion joints without provision to allow for in-plane wall or partition movement.

B. Form expansion joints in brick as follows:
   1. Build flanges of factory-fabricated, expansion-joint units into masonry.
   2. Build in compressible joint fillers where indicated.
   3. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch (9.52 mm) for installation of sealant and backer rod specified in Division 07 Section "Joint Sealants".

C. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 07 Section "Joint Sealants", but not less than 3/8 inch (9.52 mm).
   1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.10 LINTELS

A. Install steel lintels where indicated.

B. Provide minimum bearing of 8 inches (203.2 mm) at each jamb unless otherwise indicated.

3.11 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.

B. Install flashing as follows unless otherwise indicated:
   1. At Masonry Backup Wall: Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.

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2. At lintels and shelf angles, extend flashing a minimum of 6 inches (152.4 mm) into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches (50.8 mm) to form end dams.
3. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (12.7 mm) back from outside face of wall and adhere flexible flashing to top of metal flashing termination.
4. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.

C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

D. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
1. Use specified weep/vent products to form weep holes.
2. Use wicking material to form weep holes above flashing under brick sills. Turn wicking down at lip of sill to be as inconspicuous as possible.
3. Space weep holes formed from plastic tubing or wicking material 24 inches (609.6 mm) o.c.
4. Trim wicking material flush with outside face of wall after mortar has set.

E. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material.

F. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/vent products to form vents.
1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

3.12 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean brick by bucket-and-brush hand-cleaning method described in "BIA Technical Notes 20".
6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

END OF SECTION

SECTION 05 12 00
STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 1 Specification Sections apply to work on this Section.

1.02 DESCRIPTION OF WORK

A. Provide structural steel work as shown on drawings and specified herein. Hoisting of the metal deck shall be the responsibility of Contractor. Structural steel is that work defined in AISC "Code of Standard Practice" and as otherwise shown on drawings.

1.03 QUALITY ASSURANCE

A. Codes and Standards

1. Comply with provisions of following, except where more stringent requirements are shown or specified
2. AISC "Code of Standard Practice for Steel Buildings and Bridges."
3. AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings," including the "Commentary" and Supplements thereto as issued.
4. AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts" approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation.
5. AWS D1.1 "Structural Welding Code," latest editions.
6. ASTM A 6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use.

B. Qualifications for Welding Work

1. Qualify welding processes and welding operators in accordance with the WS "Standard Qualification Procedure."
2. Provide certification that welders to be employed in the work have satisfactorily passed AWS qualification tests within the previous 12 months.
3. If recertification of welders is required, retesting will be the Contractor's responsibility and at his expense.

1.04 COORDINATION

A. Contractor shall fully coordinate the structural steel work. Coordinate with Metal Deck Installer for hoisting of the metal deck.

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B. Contractor shall fully verify all dimensions and details. Any discrepancies shall be immediately reported to the Architect.

C. Contractor shall locate dimensionally on setting plans all anchor bolts, inserts, base plates, etc. and shall prepare and deliver all required templates and fully dimensioned setting plans, all in time for the proper execution of the work.

D. Contractor shall set the anchor bolts and inserts. Contractor shall field survey all such settings for correctness after they have been cast in place, and before proceeding with steel erection. Checking shall be performed within ten days of notification by concrete installer that his work is complete.

E. Contractor shall within 10 days report to the Architect and certify that he has complied with the above checking requirements and shall indicate any inaccuracies found and corrections which must be made. Any inaccuracies not included in this report and found during or after steel erection shall be the responsibility of the Contractor, and the cost of corrective measures shall be borne by him.

F. Use base lines, bench marks, or other standards for survey work. If permanent building bench marks have been established, they will be used for the aforementioned field checking.

G. Contractor shall coordinate erection areas and sequence and temporary bracing locations.

1.05 SUBMITTALS

A. Product Data

1. Submit 4 copies of producer's or manufacturer's specifications and installation instructions for following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).

    a. Structural Steel (each type), including certified copies of mill reports covering the chemical and physical properties.
    b. High strength bolts.
    c. Structural steel primer paint.

B. Shop Drawings

1. Shop drawings shall give all necessary information for the fabrication and erection of the structure and shall be based on AISC Specifications. Minimum connections used shall be as indicated on the drawings and shall support the total uniform load capacity of members. Provisions for the connection of other work required shall be indicated and provided by Steel Installer. Index sheets shall be furnished with all beam and column details at the same time the details are submitted for the review of the Architect. Standard connection details

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conforming to those shown on the drawings shall be submitted with first erection plan. All details shown are typical; similar details apply to similar conditions, unless otherwise indicated.

2. The review of shop drawings shall be for size and arrangement of principal members and strength of connections only.
3. Provide anchor bolt and setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed by others.
4. Promptly notify the Engineer whenever design of members and connections for any portion of the structure are not clearly indicated.
5. Shop drawings shall bear the initials of the detailer's checker prior to submission.
6. Shop drawings shall indicate the sequence and extent of areas to be erected by using division or derrick numbers.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to site at such intervals to insure uninterrupted progress of work.

B. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time so as not to delay that work.

C. Store materials to permit easy access for inspection and identification. Keep steel members off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration. The Contractor shall be responsible for any demurrage charges due to failure to unload or store materials properly. Structural steel shall be kept properly drained. Do not store materials on the structure in a manner that might cause distortion or damage to the members of the supporting structures.

D. Protection: Use all means necessary to protect the materials of this Section before, during, and after installation, and to protect the installed work and materials of all other trades.

E. Replacement: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

F. Shop Fabrication and Assembly

1. Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on approved shop drawings. Provide camber in structural members where indicated.
2. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.

G. Connections

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1. Shop connections shall be welded or high strength bolted. Field Connections shall be bolted with high strength bolts in friction-type connections conforming to ASTM Designation A325, except where welded connections or other connections are indicated.
2. Combinations of bolts and welds in the same connections are not permitted, unless otherwise shown on the drawings.
3. Where structural joints are made using high strength bolts, hardened washers and nuts tightened to a high tension; the materials, methods of installation and tension control, type of wrenches to be used, and inspection methods shall conform to ASTM Designation A325 as approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation. Each bolt shall have a hardened washer under the nut.
4. The high strength bolts used shall have a suitable identifying mark placed on top of the head before leaving the factory.
5. Tightening of nuts shall be done with properly calibrated pneumatic wrenches. The minimum bolt tension for the size of the bolt used shall be in accordance with tables listed in the above referenced Standards. Each wrench shall be checked for accuracy at least once daily for actual conditions of application.
6. Bolts that have been completely tightened shall be marked with identifying symbols.
7. The Contractor shall have a properly calibrated torque gauge on hand, and when requested by the Architect, shall provide a check on any bolt at any time until final acceptance of the work by the Owner.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Metal Surfaces, General: For fabrication of work which will be exposed to view, use only materials which are smooth and free of surface blemishes, including pitting, seam markers, roller marks, rolled trade names, and roughness. Remove such blemishes by grinding or by welding and grinding prior to cleaning, treating, and application of surface finishes.

B. Structural Steel Shapes, Plates, and Bars: ASTM A36

C. Steel Pipe: ASTM A53, Types E or S, Grade B.

D. Anchor bolts shall conform to ASTM A307 with size and shape as indicated on the drawings.

E. Column Base Plates: ASTM A36

F. Arc Welding Electrodes shall conform to the AWS Code as Revised. All electric current require shall be furnished by Contractor.

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G. Paint for Shop Painting Structural Steel and Field Touch-up shall be manufacturer's standard primer.

H. All items exposed to weather, such as shelf angles and items as noted on the drawings, shall be zinc coated in accordance with the provisions of ASTM Designation A123 as revised to date.

2.02 FABRICATION

A. General: Fabricate items of structural steel in accordance with AISC Specifications and as indicated on the approved shop drawings.

B. Bearing surfaces shall be planed to true beds, and abutting surfaces shall be closely fitted. All columns and bearing stiffeners shall be milled to give full bearings.

C. Bolt holes shall be drilled or punched in accordance with AISC Specifications, subject to the provisions specified herein. Holes shall be accurately centered and shall register true upon erection. Poor matching of holes shall be cause for a rejection. Small errors may be repaired by drilling or reaming.

D. Contact surfaces shall be thoroughly cleaned before assembly. Assembled parts shall be brought into close contact. Drift pins shall be used only for aligning members and shall not be used in a manner which will damage metal or enlarge or distort holes. Members requiring accurate alignment shall be provided with slotted holes and/or washers for truing up the steel as required. All finished members shall be true to line and free from twists, bends, and open joints.

E. Welding shall be performed by operators qualified in accordance with the American Welding Society "Standard Qualification Procedure" to perform the type of work required. Such qualification test shall have been passed within the preceding 12-month period. Shop drawings shall indicate the size, length, spacing, and type of all welds. Comply with AWS Code for procedures, appearance and quality of welds, and for methods used in correcting welding work.

F. Holes for Other Work: Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members, as shown on approved shop drawings.

G. Provide threaded nuts welded to framing and other specialty items as indicated to receive other work.

H. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.

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2.03 SHOP PAINTING

A. Provide one shop coat of paint as specified under Article "Materials" to all steel except for members receiving galvanizing or as specified hereafter.

B. Paint shall be delivered to the shop in original sealed containers which shall be clearly marked with the manufacturer's name and the identifying brand number or name. The paint shall be used as prepared by the manufacturer without thinning or other admixtures.

C. Surface Preparation: After inspection and before shipping, clean steelwork to be painted complying with Steel Structures Painting Council (SSPC) SP-2 "Hand Tool Cleaning," or SSPC SP-3 "Power Tool Cleaning."

D. Do not paint contact surfaces which are to be welded or high-strength bolted. No paint shall be applied within 3" of any high strength bolt holes.

E. Do not paint any zinc-coated items.

F. Paint shall be applied under dry and dust-free conditions and unless otherwise allowed by the Architect, shall not be applied when the temperature is below 45 deg. F. Painting shall be done in workmanlike manner so as to produce an even dry film of uniform thickness of 2 mil. Edges, corners, crevices, and joints shall receive special attention so that they are thoroughly cleaned and they receive an adequate thickness of paint.

PART 3 - EXECUTION

3.01 ERECTION

A. General: Installer must examine the areas and conditions under which structural steel work is to be installed, and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

B. Codes: Comply with the AISC Specifications and Code of Standard Practice, and as herein specified. Maintain work in a safe and stable condition during erection.

C. Anchor Bolts: Steel installer shall furnish anchor bolts and other connectors required for securing structural steel to foundations and other in-place work. Steel installer shall furnish templates and other devices as necessary for presetting bolts and other anchors to accurate locations. Contractor shall set anchor bolts and other insert anchors required.

D. Field Assembly: Set structural members to the lines and elevations indicated. Align and adjust the various members forming a part of a complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces which will be in

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permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

E. Temporary Shoring and Bracing: Provide as required, with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy line to achieve proper alignment of the structures as erection proceeds. Coordinate locations of temporary bracing with the Contractor.

F. Splice members only where indicated.

G. Do not enlarge unfair holes in members by burning or by the use of drift pins. Ream or drill holes that must be enlarged to admit bolts.

H. Do not use gas cutting torches in the field for correcting fabrication errors in the structural framing.

I. Touch-up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of the shop paint, and paint all exposed areas with the same materials as used for shop painting. Apply by brush or spray to provide a minimum dry file thickness of 2.0 mils.

3.02 QUALITY CONTROL

A. The Contractor shall notify the Architect in writing five days in advance of the starting of fabrication and of erection of the structural steel.

B. The Owner and his agents shall have free access and the Contractor shall provide same, to all points where materials for this project are being fabricated and/or erected, and all materials, equipment and workmanship shall be subject to inspection, tests and approval by the Owner's agents or laboratories. They shall have full authority to reject all material and work that fails to conform in every respect to these specifications.

C. Owner will engage in independent testing and inspection agency to inspect high-strength bolted connections and welded connections and to perform tests and prepare test reports.

D. Testing agency shall conduct and interpret tests and state in each report whether test specimens comply with requirements and specifically state any deviations therefrom.

E. Testing agency may inspect structural steel at plant before shipment; however, Architect reserves right, at any time before final acceptance, to reject material not complying with specific requirement.

F. Shop inspection will include periodic inspection at the place of fabrication and identification of tested material, checking of fabrication for compliance with approved

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shop drawing and these Specifications, and inspection of shop painting, as well as the following:

1. Examination of all steel for straightness and alignment.
2. Examination of all fabricated pieces and checking of same with erection plans and detail drawings.
3. Shop-Bolted Connections: Inspect in accordance with AISC Specifications. See paragraph entitled "High Strength Bolt Inspection" below.
4. Shop Welding: Inspect and test during fabrication of structural steel assemblies as follows:

    a. Check that welders are certified. Record type and locations of defects found in work. Record work required and performed to correct deficiencies or defects found.
    b. Perform periodic visual inspections of random welds.
    c. Perform the following:

        1. Ultrasonic Inspections: ASTM E164. 100% of first 400 butt welds or more until rejection rate is less than 5% and then 25% as long as rejection rate remains below 5%.
        2. Magnetic Particle Testing: ASTM E109. 25% of fillet welds with size larger than 3/8".

5. Examination of surface preparation, painting/priming and galvanizing.

G. Field inspection will include periodic inspection after delivery at site of material, fabrication, and shop painting, and work connected with erection and field painting of steel structure, as well as the following:

1. Proper erection of all pieces.
2. Proper installation of bolts.
3. Plumbness of structure.
4. Condition of shop painting after erection and field touch-up painting.
5. Field-Bolted Connections: Inspect in accordance with AISC specifications. See paragraph below titled "High-Strength Bolt Inspection."
6. Field Welding: Inspect and test during erection of structural steel as follows:

    a. Check that welders are certified. Record types and locations of defects found in work. Record work required and performed to correct deficiencies or defects found.
    b. Perform periodic visual inspections of random welds.
    c. Perform the following:

        1. Ultrasonic Inspection: All penetrating welds performed in the field shall be tested by ultrasonic testing.
        2. Magnetic Particle Testing: Perform as described above.

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3. High Strength Bolt Inspection: Perform inspection of installation of high-strength bolts to determine that selected installation procedures as prescribed in the Specification for structural joints using ASTM A325 or A490 bolts are properly used and that bolts are properly tightened and as follows:

    a. All bolted connections shall be visually inspected.
    b. At least two bolts of every connection between girders and columns and trusses and columns shall be checked.
    c. All bolted connections that fail shall be corrected and all bolts in that connection shall be retested.

H. Contractor shall correct deficiencies in structural steel work, which inspections and laboratory test reports have indicated to be not in compliance with requirements, perform additional tests, at Contractor's expense, as may be necessary to re-confirm any non-compliance of the original work, and as may be necessary to show compliance of corrected work.

I. When required by Architect or Contractor's engaged Inspection Organization, Contractor shall make available to Inspector a calibrated torque wrench and calibrating device, as well as the manpower required to operate same, for the purpose of checking high-strength bolts. Adequate platforms and scaffolding shall be provided to ensure safe performance of this operation.

J. Report Copies and Timing: Immediately after tests or inspection have been made, and in no case later than seven (7) days after tests of inspection have been made, the laboratory shall furnish copies of all test and inspection reports as follows:

1. One (1) copy to Contractor.
2. One (1) copy to Master Consulting Engineers, Inc.
3. One (1) copy to Owner.

END OF SECTION 05 12 00

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SECTION 05 20 00 - METAL JOISTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Work of this section shall conform to the requirements of the Contract Documents, including the General Conditions, Supplementary General Conditions, Special Conditions, and Division 1 General Requirements.

1.02 DESCRIPTION

A. Work Included: The extent of steel joists is shown on the drawings, (including basic layout, size and type of joists required) and specified herein.

B. Related Work Described Elsewhere

1. Structural Steel: Section 05 10 00

2. Metal Decking: Section 05 30 00

1.03 QUALITY ASSURANCE

A. Provide joists fabricated in compliance with the following, and as herein specified.

1. Steel Joist Institute (SJI) Standard Specifications, Load Tables and Weight Tables for:

a. K - Series Open Web Steel Joists

b. LH - Series Long Span Open Web Steel Joists

c. DLH - Series Deep Long Span Steel Joists

B. Qualification of Field Welding

1. Qualify welding processes and welding operators in accordance with the (AWS) standard qualifications procedure.

2. Joists welded in place are subject to inspection and testing by a Testing Agency engaged by the Owner. Remove and replace work found to be defective and provide new acceptable work.

1.04 GENERAL PRODUCT REQUIREMENTS

A. Differential deflection or camber in adjacent joists in their erected position shall not exceed 1/2" in order to allow for metal deck erection.

B. All joists shall be delivered in one piece. Splices will not be allowed.

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1.05 SUBMITTALS

A. Product Data: Submit manufacturer's specifications catalog and installation instructions for each type of joist and accessories. Include manufacturer's certification that joist comply with SJI "Specifications".

B. Shop Drawings: Submit detailed drawings showing layout of joist units, special connections, jointing, and accessories. Include mark, number, type, location and spacing of joists and bridging.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle steel joists as recommended in SJI "Specifications". Handle and store joists in a manner to avoid deforming members and to avoid excessive stresses. Special care shall be taken to store joists to prevent defacing with mud or other foreign matter or damage to shop paint. Joists which become damaged shall be replaced or repaired at the expense of the Contractor.

1.07 JOB CONDITIONS

A. Time of Completion and Procedure of Construction: Time of Completion is a matter of utmost importance in connection with this Contract. By the submission of a bid, this Contractor agrees to diligently perform his work so as to assure completion within the time limits and Pre-Bid CPM Schedule.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Steel: Comply with SJI "Specifications".

B. High Strength Bolts and Nuts: ASTM A325.

C. Steel Prime Paint: Comply with SJI "Specifications".

2.02 FABRICATION

A. General: Fabricate steel joists in accordance with SJI "Specifications".

B. Holes in Chord Members: Provide holes in chord members where shown for securing other work to steel joists; however, deduct area of holes from the area of chord when calculating strength of members.

C. Extended Ends: Provide extended ends on joists where shown, complying with manufacturer's standards and requirements of applicable SJI "Specifications" and load tables.

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D. Ceiling Extensions: Provide ceiling extensions where ceiling occur for all joists to permit ceiling to be attached directly to joist bottom chord. Provide an extended bottom chord element to suit manufacturer's standards, of sufficient strength. Extend ends of bottom chord to within 5" of column grid line unless otherwise indicated.

E. Bridging: Provide diagonal type or top and bottom horizontal bridging. Refer to structural drawings for number of rows and type of bridging.

1. Provide bridging anchors for ends of bridging lines terminating at walls or beams.

F. End Anchorage: Provide anchorages to secure joist to adjacent construction, complying with SJI "Specifications" unless otherwise indicated.

G. Header Units: Provide header units at panel points to support tail joists at openings in roof system not framed with steel shapes.

H. Shop Painting

1. Remove loose scale, heavy rust, and other foreign materials from fabricated joists, braiding, anchors, and accessories before application of shop paint.

2. Apply one coat of primer paint to steel joists and accessories, by spray, dipping, or other method to provide a continuous dry paint film thickness of not less than 0.50 mil. Bituminous type primers will not be allowed.

PART 3 - EXECUTION

3.01 INSPECTION

A. Erector must examine areas and conditions under which steel joists are to be installed and notify Architect in writing of conditions detrimental to proper and timely completion of work.

3.02 ERECTION

A. Place and secure steel joists in accordance with SJI "Specifications", final shop drawings, and as herein specified.

3.03 PLACING JOISTS

A. Do not start placement of steel joists until supporting work is in place and secured. Place joists on supporting work, adjust and align in accurate locations and spacing before permanently fastening.

B. Provide temporary bridging, connection, and anchors to ensure lateral stability during construction.

C. Where "open web" joist lengths are 40 feet and longer, install a center row of bolted bridging to provide lateral stability before slackening of hoisting lines.

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3.04 BRIDGING

A. Install bridging simultaneously with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords where terminating at walls or beams.

3.05 FASTENING JOISTS

A. Set joists level or true to line at spacing indicated. Provide minimum bearings shown. Install accessories, including headers, anchors, trimmers, and ceiling extensions, and other items as indicated. Provide bridging as shown, and in accordance with AISC requirements.

B. Joists resting on steel supports shall be field welded to each support in accordance with SJI "Specifications" for type of joists used. Coordinate welding sequence and procedure with placing of joists.

1. Bolted connections, if any, shall conform to the AISC "Specifications for Structural Joints using ASTM A325 Bolts".

3.06 TOUCH-UP PAINTING

A. After joist installation, paint field bolt heads and nuts, welded areas, abraded or rusty surfaces on joists and steel supporting members. Wire brush surfaces and clean with solvent before painting. Use same type of paint as used for shop painting.

PART 4 - QUALITY CONTROL TESTING

4.01 TESTING AND INSPECTION

A. General: The Owner shall provide and pay for the services of test laboratory under a separate contract, for Steel Joist quality control, as enumerated in this specification. The Owner shall select the test laboratory.

B. Codes: The testing laboratory will inspect for compliance with contract documents and all applicable ASTM, SJI Codes and Standards. Five (5) typical joists. Visual inspection of field welds for joists to steel frame etc.

C. Qualify welding processes and welding operators in accordance with the AWS "Standard Qualification Procedure".

D. Reports on Inspection: Submit reports on this inspection. Reports shall include detailed data with respect to all requirements of the specifications referenced. Materials or workmanship not meeting the requirements of the contract documents, either at the plant or project site, will be rejected by the testing laboratory and immediately reported to the Contractor and the Architect. In no case shall the laboratory recommend any method of adjustment or correction. Include in all reports the project title and number, location, Contractor's name, and date work was performed.

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E. Report Copies and Timing: Immediately after tests or inspection have been made, and in no case later than seven (7) days after tests of inspection have been made, the laboratory shall furnish copies of all test and inspection reports as follows:

1. One (1) copy to the Architect.

2. One (1) copy to McDevitt & Street Company.

3. One (1) copy to Master Consulting Engineers, Inc.

4. One (1) copy to the Structural Steel Contractor.

5. One (1) copy to Shannon Properties.

END OF SECTION 05 20 00

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SECTION 05 21 00 - STEEL JOIST FRAMING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 1 Specification Section, apply to work of this section.

1.02 DESCRIPTION OF WORK

A. Provide steel joists work as shown on the drawings and specified herein.

B. Related Work Specified Elsewhere

1. Structural Steel: Section 05 10 00.

2. Metal Decking: Section 05 30 00.

C. REFERENCES (All latest editions)

1. ASTM A 307: Carbon Steel Threaded Standard Fasteners.

2. ASTM A 325: High Strength Bolts for Structural Steel Joints.

3. AWD D1.1: Structural Welding Code.

4. SSPC: Steel Structures Painting Council.

5. Steel Joist Institute (SJI): Standard Specification for Open Web Steel Joists, K-Series, Standard Specifications for Long Span Steel Joists, LH Series and Deep Long Span Steel Joists, DLH Series, and Standard Specification for Joist Girders.

1.03 QUALITY ASSURANCE

A. Conform to SJI Standard Specifications, Load Tables, and Weight Tables.

1.04 SHOP DRAWINGS

A. Indicate profiles, sizes, spacing, and locations of structural members, connections, attachments, fasteners, cambers, and loads.

B. Indicate specified procedures concerning erection and fastening of steel joists.

PART 2 - PRODUCTS

2.01 PRODUCTS

A. Open Web Steel Joist Members: SJI Type K Open Web and Type LH longspan.

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B. Primer Manufacturer's standard primer.

2.02 FABRICATION

A. Fabricate steel joists in accordance with SJI Standard Specifications, including headers, supplementary framing, and cambers.

B. Provide bottom and top joist chord extensions when indicated.

C. Clean steel work to be painted complying with Steel Structures Painting Council, SSPC SP-3, "Power Tool Cleaning".

D. Shop prime structural steel members. Do not prime surfaces to be field welded or high strength bolted.

PART 3 - EXECUTION

3.01 ERECTION

A. Erect steel joists in accordance with SJI Standard Specifications.

B. Bear joists on supports in accordance with SJI Standard Specifications and the drawings.

C. During erection, provide temporary bracing for induced loads and stresses.

D. Field weld joist seat to bearing surface after aligning and positioning joists and after installation of bridging. Deep longspan joists and joist girders shall be high strength bolted.

E. Do not field cut or alter joists without approval of the Architect.

F. After erection, prime welds, abrasions, and surfaces not primed. Use the same primer as the specified shop coat.

END OF SECTION 05 21 00

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SECTION 05 30 00 - METAL DECKING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 1 Specification Section, apply to work of this section.

1.02 DESCRIPTION OF WORK

A. Provide metal decking as shown on the drawings, including basic layout and type of deck units required, and specified herein.

B. Related Work Described Elsewhere

1. Structural Steel - Section 05 10 00.

1.03 QUALITY ASSURANCE

A. Codes and Standards

1. Comply with provisions of the following codes and standards, except as otherwise shown or specified.

2. AISI "Specifications for the Design of Cold-Formed Steel Structural Members."

3. AWS "Structural Welding Code."

4. SDI "Design Manual for Floor Decks and Roof Decks."

5. MRDTI "Specifications for Steel Roof Deck Construction" as adopted by the Metal Roof Deck Technical Institute.

B. Qualifications of Field Welding

1. Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure." Welding decking in place is subject to inspection and testing by a Testing Laboratory engaged by the Owner.

   Remove and replace work found to be defective and not complying with requirements.

1.04 PERFORMANCE REQUIREMENTS

A. Uplift Loading: Install and anchor roof deck units to resist gross uplift loading of 91.5 psf at high roof overhang, 76.5 psf at low roof overhang, 52.0 psf at Zone 1 roof area and 62.8 psf at Zones 2 and 3 roof areas.

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B. Underwriter's Label: Provide metal deck units manufactured by a firm listed in the Underwriter's laboratories "Fire Resistance Director - Index of Manufacturers." Each required type deck unit shall bear the UL label and marking.

1.05 SUBMITTALS

A. Product Data: Submit four copies of manufacturer's specifications and installation instructions for each type of decking and accessories. Include manufacturer's certification as may be required to show compliance with these specifications.

B. Shop Drawings: Submit detailed drawings showing size and location of floor and roof framing supports, layout and types of deck panels, deck finish and method, lengths and piece marks of deck units, fastening and anchorage details, and any openings to be cut in field. Deck units shall be marked to show sequence or erection. Detailed drawings shall also indicate closure pieces, fittings, sump pans, any special jointing, and other accessories necessary to provide a complete decking installation. Indicate welds by standard welding symbols adopted by The American Welding Society. Weld washers shall be used for all roof deck.

1.06 COORDINATION

A. Contractor shall coordinate loading of deck units on the steel frame and erection sequence with Structural Steel Installer. Contractor shall coordinate the actual size and depth of sump pans.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Metal Deck

B. Roof Deck Units: Roof deck shall be galvanized (G90) metal deck. See “Roof Framing Notes” in the roof plan for size and locations. Areas where insulating systems are used, galvanized (G90) metal deck, size and location per “Roof Framing Notes”.

C. Floor Deck Units: Floor deck shall be galvanized (G90) metal deck. See “Floor framing Notes” in the floor plans for size and locations.

D. Metal Cover Plates: Fabricate metal cover plates for end-abutting deck units of not less than 18 gage sheet steel. Form to match contour of deck units and approximately 6 inches wide.

E. Metal Closure Strips: Fabricate metal closure strips, for openings between decking and other construction, of not less than 18-gage sheet steel. Form to provide tight-fitting closure at open ends of cells or flutes and sides of decking.

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PART 3 - EXECUTION

3.01 INSPECTION

A. Installer must examine areas and conditions under which metal decking is to be installed and notify Contractor in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until satisfactory conditions have been corrected in a manner acceptable to installer.

3.02 INSTALLATION

A. General: Install deck units and accessories in accordance with manufacturer's recommendations and approved shop drawings, and as specified herein.

B. Place deck units on supporting steel framework and adjust to final position with ends accurately aligned and bearing on supporting members before being permanently fastened. Do not stretch or contract side lap interlocks.

C. Place deck units in straight alignment for entire length of run.

D. Place deck units flat and square, secured to adjacent framing without warp or excessive deflection.

E. Coordinate and cooperate with structural steel installer in loading decking bundles to prevent overloading of structural members.

F. Do not use floor deck units for storage or working platforms until permanently secured.

G. End Closures: Tack weld or use machine screws at 3'-0" o.c. for fastening end closures.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, the appearance and quality of welds, and the methods used in correcting welding work.

I. Side Laps: Steel roof deck and floor deck shall have nesting side laps of adjacent units attached by 3/4-inch diameter #12 screws or button punching at the center of each span or 30 inches o.c., whichever is a least dimension, unless noted otherwise on plans.

J. Cutting and Fitting: Saw cut and neatly fit deck units and accessories around other work projecting through or adjacent to the decking as shown on the drawings.

K. Joint Covers: Provide metal joint covers at abutting ends and changes in direction of floor deck units.

L. Closure Strips: Provide metal closure strips at all open perimeter ends, interior openings, uncovered ends and edges of roof and floor decking, and in the voids between decking and other construction. Weld into position to provide a complete decking installation.

M. Touch-Up Painting: After decking installation, wire brush, clean and paint scarred areas, welds and rust spots on the top surface of roof deck units.

N. Touch-up painted surfaces with the above specified paint applied in accordance with the manufacturer's instructions.

END OF SECTION 05 30 00

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SECTION 05 40 00 – COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Non-load bearing metal stud and partition framing, with anchorage and bracing.

B. Related Documents: The Contract Documents, as defined in Section 01 11 00 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.2 REFERENCES

A. American Iron and Steel Institute (AISI)

1. “Specification for the Design of Cold-Formed Steel Structural Members.”

2. “Cold-Formed Steel Design Manual” (Latest).

B. American National Standards Institute (ANSI)

1. ANSI A58.1 - “Roof, Wind and Snow Loads.”

C. American Society for Testing and Materials (ASTM)

1. ASTM A446 - Steel Sheet, Zinc-coated (galvanized) by Hot-Dip Process, Structural (Physical) Quality.

2. ASTM A570 Hot-Rolled Carbon Steel Sheet & Strip, Structural Quality.

3. ASTM A525 - Sheet Steel, Zinc-Coated (Galvanized) by the Hot-Dip Process, General Requirements.

4. ASTM A611 - “Standard Specification for Steel, Cold-Rolled Sheet, Carbon, Structural.”

5. ASTM C955 - “Standard Specification for Lead Bearing Steel Studs, Runners (Track), Bracing, and Bridging.”

D. American Welding Society (AWS):

1. AWS D1.1 - “Structural Welding Code” and D1.3. - “Specifications for Welding Sheet Steel in Structures.”

2. AWS - “Standard Qualification Procedure.”

E. Federal Specification:

1. FS TT-P-636C - Rust Inhibitive Paint.

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F. Metal Lath/Steel Framing Association (ML/SFA) - “Lightweight Steel Framing Systems Manual,” latest Edition.

1.3 SYSTEM DESCRIPTION

A. Design Requirements: The supplier shall design and/or verify the size and strength of all light gauge cold-formed Metal Framing members and connections in accordance with the ML/SFA Lightweight Steel Framing Systems Manual.

1. Design shall use the superimposed design loads specified in the “Design Criteria” section of the “Structural General Notes” in the contract drawings.

2. Design shall be based on the Standard Building Code 1997 Edition for a wind speed of 102 mph.

3. Design shall conform to: AISI Specification for the Design of Cold-Formed Steel Structural Members. Wall bridging shall be designed to provide resistance to minor axis bending and rotation of wall studs. Designated selected exterior and/or interior walls shall be designed to provide frame stability and lateral load resistance. All connections (member to member, and member to structure) shall be designed and detailed.

4. Qualification of Field Welding: quality welding process and welding operators in accordance with AWS “Standard Qualification Procedure.”

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Procedures for submittals.

1. All shop drawings and calculations must bear the seal and signature of an Engineer registered in the State of Florida.

2. Product Data

a. Manufacturer’s literature containing product and installation specifications and details.

3. Shop Drawings

a. Documents illustrating materials, shop coatings, steel thickness, details of fabrication and erection, details of attachment, spacing of fasteners, required accessories and critical installation procedures.

4. Calculations

a. Engineering calculations or data verifying the framing assembly’s ability to meet or exceed design requirements as stated here-in and required by local codes, prepared under the supervision of a Professional Engineer.

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5. Assurance/Control Submittals
   a. Test Reports: Submit the following reports to the Architect, with copy to Contractor.
      1. Testing/Inspection reports conducted on shop and field-bolted and welded connections. Include data on type(s) of tests conducted and test results. Note inspection findings.
   b. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
   c. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.

1.5 QUALITY ASSURANCE

A Qualifications

1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
2. Installed: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

B. Pre-Installation Meetings

1. Convene a pre-installation meeting one week prior to commencing work of this section. Notify the Architect of the meeting date and time at least 7 days prior.
2. Require attendance of parties directly affecting work of this section.
3. Review conditions of operations, procedures and coordination with related work.

C. Agenda

1. Tour, inspect, and discuss conditions of installation of other work including door and window frames and mechanical and electrical work.
2. Review areas of potential interference and conflicts, and coordinate layout and support provisions for interfacing work.
3. Review required submittals, both completed and yet to be completed.
4. Review drawings.
5. Review and finalize construction schedule related to cold-formed metal framing installation and verify availability of materials, personnel, equipment, and facilities needed to make progress and avoid delays.

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6. Review required inspections, testing, certifying, and material usage accounting procedures for coping with unfavorable conditions.

7. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions.

8. Review safety precautions relating to operations.

1.6 DELIVERY, STORAGE, AND HANDLING

A. SECTION 01 60 00 - Product Requirements: Transport, handle, store and protect products.

B. Protect metal framing units from rusting and damage. Deliver to project site in manufacturer's unopened containers or bundles, fully identified with name, brand, type and grade. Store off ground in a dry ventilated space or protect with suitable waterproof coverings and protect against mechanical damage to units. Store materials on a flat plain. Any damaged materials shall be removed from the site.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All studs and/or joists and accessories shall be of the type, size, gauge and spacing shown on the plans or as required by manufacturer design, if called for. Studs, runners (track), bracing, and bridging shall be manufactured per ASTM Specification C-955.

B. All galvanized studs, joists and accessories shall be formed from steel that conforms to the requirements of ASTM A-466, as set forth in Section 1.2 of the AISI Specification for Design of Cold-Formed Steel Structural Members (latest edition).

C. All galvanized studs, joists and accessories shall have a minimum G-60 coating.

D. All section properties shall be calculated in accordance with the AISI Specification for the Design of Cold-Formed Steel Structural Members (latest edition).

2.2 FABRICATION

A. General: Framing components may be prefabricated prior to erection. Fabricate components plumb, square, true to line and braced against racking with joints welded. Perform lifting of prefabricated components in a manner to prevent damage or distortion.

B. Fastenings: Attach similar components by welding. Attach dissimilar components by bolting, or screw fasteners, as standard with manufacturer.

C. Wire tying of framing components is not permitted.

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PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 - Execution Requirements: Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive work.

C. Report in writing to the Architect prevailing conditions that will adversely affect satisfactory execution of the work of this section. Do not proceed with work until unsatisfactory conditions have been corrected.

D. By beginning work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost.

3.2 INSTALLATION OF STUDWALLS

A. Manufacturer's Instructions: Install metal framing systems in accordance with manufacturer's printed or written instructions and recommendations, unless otherwise indicated.

B. Stud Walls

1. Runner Tracks: Install continuous tracks sized to match studs. Align tracks accurately to layout at base and tops of studs. Secure tracks as recommended by stud manufacturer for type of construction involved, except do not exceed 24 inches on center spacing for nail or power-driven fasteners, or 16 inches on center for other types of attachment. Provide fasteners at corners, at ends of tracks and at stud locations.

2. Position studs plumb in runners and space no greater than 16 inches and not more than 2 inches from abutting walls and at each side of openings. Connect studs to upper and lower tracks using self-drilling, screws or welding in accordance with Manufacturer's recommendations such that the connection meets or exceeds the design loads required at that connection.

3. Brace all studs at mid-height for added strength, stiffness, and fire-stopping.

4. Construct corners using minimum of three studs. Double studs at door, window and sidelight jams. Install intermediate studs above and below openings to match wall stud spacing.

5. Provide deflection allowance below supported horizontal building framing in ceiling or head track for non-load bearing framing in a method recommended by stud manufacturer.

a. Where walls and partitions must close out against the deck for smoke and fire separation, provide a top track rigidly attached to vertical studs but free to move vertically in a 14 gauge break-

formed deep leg track rigidly attached to deck with slack to accommodate structural live load deflections noted on drawings.

b. Where wall or partition studs pass by the structural deck provide vertical slide clips welded or screw attached to the structural support but do not attach rigidly to studs.

3.3 INSTALLATION: PRE-FABRICATED AND PANELIZED CONSTRUCTION

A. Panels shall be designed to resist construction and handling loads as well as service loads.

3.4 INSTALLATION: NON-PANELIZED (STICK-BUILT) MEMBERS

A. Align track accurately at supporting structure and fasten to structure as shown on shop drawings.

B. Track intersections shall butt evenly.

C. Studs shall be plumbed, aligned and securely attached to flanges or welds of upper and lower tracks. Axially loaded studs shall be seated squarely in both top and bottom tracks.

3.5 INSTALLATION: JOISTS

A. Joist shall be located directly over bearing studs or a load distribution member shall be provided to transfer loads.

B. Provide web stiffeners where necessary at reaction points, and at points of concentrated loads, as shown on the shop drawings.

C. Bridging, either strap or solid, shall be provided as shown on the shop drawings.

D. Provide additional joists under parallel partitions where the partition length exceeds ½ of the joist span.

E. Provide additional studs around all openings which are larger than the stud spacing and as noted on the shop drawings.

F. End blocking shall be provided where joist ends are not otherwise restrained from rotation.

3.6 FASTENING AND ATTACHMENTS

A. Anchorage of the tracks to the structure shall be with methods designed for the specific application of sheet to that surface. Size, penetration, type and spacing shall be determined by design.

B. Welds shall conform to the requirements of AWS D1.1, AWS D1.3, and AISI Manual Section 4.2. Welds may be butt, fillet, spot, or groove type, the appropriateness of which shall be determined by, and within the design calculations. All welds shall be touched-up using zinc rich paint to galvanized members, and paint similar to that used by the manufacturer for painted members.

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C. Steel drill screws shall be of the minimum diameter indicated by the design of that particular attachment detail. Penetration through joined materials shall not be less than 3 exposed threads.

D. Wire tying in structural applications is not permitted.

3.7 CONSTRUCTION

A. Site Tolerances

1. Vertical alignment (plumbness) of studs shall be within 1/960th (1/8 inch in 10.0 feet) (3.175mm in 3.048m) of the span.

2. Horizontal alignment (levelness) of walls shall be within 1/960th (1/8 inch in 10.0 feet) (3.175mm in 3.048m) of their respective lengths.

3. Spacing of studs shall not be more than +1/8 inch (3.175mm) from the designed spacing providing that the cumulative error does not exceed the requirements of the finishing materials.

4. Squareness - Prefabricated panels shall not be more than 1/8 inch (3.175mm) out of square within the length of that panel.

3.8 FIELD QUALITY CONTROL

A. Section 01 45 00 - Quality Control: Field testing and inspection.

3.9 FIELD QUALITY CONTROL

A. Section 01 45 00 - Quality Control: Field testing and inspection.

1. Inspect all work in order to assure strict conformance to the shop drawings at all phases of construction.

2. All members shall be checked for proper alignment, bearing, completeness of attachments, proper placement, reinforcement, etc.

3. All attachments shall be checked for conformance with the shop drawings. All welds shall be touched-up in accordance with Section 3.6 - B.

4. General inspection of structure shall be completed prior to applying loads to those members.

5. Inspections where and as required by local codes shall be controlled inspections.

END OF SECTION 05 40 00

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SECTION 05500 - METAL FABRICATIONS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope:

1. This Section includes the fabrication, delivery, and complete installation of all miscellaneous metal fabrications as indicated on the Drawings and specified herein.

2. Miscellaneous metal work shall include, but not be limited to, the following:

a. Gate at Courtyard.

b. Miscellaneous Steel Framing and Supports.

c. Rough Hardware.

d. Safety Nosings.

e. Ladders.

f. Miscellaneous Metal Fabrications.

1.02 QUALITY ASSURANCE

A. The current rules and practice set forth in the AISC Specification and the AISC Code shall govern this Section, except as modified herein.

B. All welding shall be performed in accordance with AWS D1.01. All welding shall be performed by welders with current certificates for the type of weld being performed. Special care shall be taken to keep welding electrodes free of moisture.

C. Field measurements shall be taken prior to preparation of shop drawings and fabrication, where possible. Trimming and fitting shall be allowed for wherever taking field measurements before fabrication might delay the work.

D. Items shall be preassembled in the shop to greatest extent possible to minimize field splicing and assembly. Units shall be disassembled only as necessary for handling and shipping limitations. Disassembled units shall be clearly marked for reassembly.

E. All materials or operations specified by reference to the published specifications of a manufacturer, the American Society for Testing and Materials (ASTM), the American Iron and Steel Institute (AISC), the American Hot Dip Galvanizers Association (AHDGA), the American Welding Society (AWS), the Aluminum Association (AA) or other published standards shall comply with the requirements of the current specifications of standards listed.

1.03 PRODUCT DELIVERY AND STORAGE

A. Materials shall be delivered to the Site undamaged and shall be stored and protected from

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the elements by covering in plastic. All material damaged prior to substantial completion shall be removed from the Site and replaced at no additional cost to the Owner.

1.04 SUBMITTALS

A. Shop Drawings:

1. Submit shop drawing for fabrication and erection of miscellaneous metal fabrications. Include plans, elevations, and details of sections and connections. Anchorage and accessory items shall be shown. Templates for anchor and bolt installations shall be provided.

PART 2 - PRODUCTS

2.01 MATERIALS AND COMPONENTS

A. Metal surfaces, general

1. For fabrication of miscellaneous metal work which will be exposed to view, only materials which are smooth and free of surface blemishes such as pitting, seam marks, roller marks, rolled trade names and roughness shall be used.

B. The following shall be used except where otherwise specified or required:

1. Steel Plates, Shapes, and Bars: ASTM A 36.

2. Uncoated Cold-Rolled Structural Steel Sheet: ASTM A 611, Grade A, unless otherwise indicated or required by design loading.

3. Uncoated Cold-Rolled Commercial Quality Steel Sheet: ASTM A 366.

4. Galvanized Structural Quality Steel Sheet: ASTM A 446; Grade A, unless another grade required for design loading, and G90 coating designation unless otherwise indicated.

5. Galvanized Commercial Quality Steel Sheet: ASTM A 526, G90 coating designation unless otherwise indicated.

6. Steel Pipe: ASTM A 53; finish, type, and weight class as follows:

a. Black finish, except galvanized finish for exterior installations and where indicated.

b. Type S, Grade A, standard weight (schedule 40) unless another grade or weight or both required by structural loads.

7. Aluminum Sheet: ASTM B 221, alloy as designated.

8. Brackets, Flanges and Anchors: Cast or formed metal of the same type material and finish as supported rails.

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9. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A 47, or cast steel, ASTM A 27. Provide bolts, washers, and shims as required, hot-dip galvanized per ASTM A 153.

10. Stainless Steel, 16 Gauge Type 316 (UNS Designation S31600) of welded construction with vertical and horizontal arrows coved. Stainless steel finish #4 satin for an exposed surface unless otherwise specified.

C. Hot-dipped galvanizing or zinc coatings applied on products fabricated from rolled, pressed, and forged steel shapes, plates, bars and strips shall comply with ASTM A 123. Hot-dipped galvanized or zinc coatings for assembled steel products shall comply with ASTM A 386. Galvanized surfaces for which a shop coat of paint is specified shall be chemically treated to provide a bond for the paint. Except for bolts, nuts and other fastenings, all galvanizing shall be applied after fabrication. After welding, burned coating shall be repaired by metalizing with zinc-rich paint.
All steel specified to be hot dipped galvanization should require a G90 coating minimum.

2.02 FASTENERS

A. General:

1. Zinc-coated fasteners shall be used for exterior locations or where built into exterior walls wherever possible.

2. Fasteners and connections shall be welded wherever possible.

B. Nuts and bolts shall be regular hexagon type conforming to ASTM A 307, Grade A.

C. Lag bolts shall be square head type conforming to Federal Specification FF-B-561.

D. Machine screws shall be cadmium plated steel conforming to Federal Specification FF-S-92.

E. Wood screws shall be flat head carbon steel conforming to Federal Specification FF-W-111.

F. Washers shall be round, carbon steel conforming to Federal Specification FF-W-92.

G. Masonry anchorage devices shall be expansion shields conforming to Federal Specification FF-S-325.

H. Toggle bolts shall be tumble-wing type conforming to Federal Specification FF-B-588, type, class and style as required.

I. Lock washers shall be helical spring-type carbon steel conforming to Federal Specification FF-W-084.

2.03 GROUT

A. Nonshrink Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with CE CRD-C 621. Acceptable products/manufacturers:

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1. "Euco N-S Grout"; Euclid Chemical Co.

2. "Crystex"; L & M Construction Chemicals, Inc.

3. "Masterflow 713"; Master Builders.

4. "Sonogrout"; Sonneborn Building Products.

2.04 FINISHES/PRIMERS

A. Galvanizing, where indicated and required for all exterior surfaces): Comply with ASTM A 525 for minimum G90 coating.

B. Shop Primer for Ferrous Metals: Manufacturer's or fabricator's standard, fast-curing, lead-free, universal modified alkyd primer selected for good resistance to normal atmospheric corrosion, for compatibility with finish paint systems indicated, and for capability to provide a sound foundation for field-applied topcoats despite prolonged exposure complying with performance requirements of FS TT-P-645.

C. Galvanizing Repair Paint: High zinc dust content paint for re-galvanizing welds in galvanized steel, with dry firm containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint-20.

D. Dissimilar Metals Coating: Protective paint shall be Scotch-Clad Brand Protective Coating No. 1706 as manufactured by 3M, Minnesota Mining and Manufacturing Co., or approved equal.

2.06 FABRICATION AND MANUFACTURE

A. Gate at Courtyard:

1. Fabricate and install steel gate and frame entrance and supports, complete as shown on drawings. Provide all hardware necessary for gate operation and securement. All shapes, connectors, and fastenings shall be galvanized.

B. Miscellaneous Steel Framing and Supports:

1. Provide miscellaneous steel framing and supports which are not a part of structural steel framework, as required to complete the Work. Fabricate miscellaneous units to size, shapes and profiles indicated or, if not indicated, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise indicated, fabricate structural steel shapes, plates, and steel bars of welded construction, using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items.

2. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units are required to be installed after concrete is placed. Except as otherwise indicated, space anchors 24" on center.

3. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32"

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unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

4. Weld corners and seams continuously, complying with AWS recommendations. At exposed connections, grind exposed welds smooth and flush to match and blend with adjoining surfaces.

5. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use phillips flat-head (countersunk) screws or bolts for exposed fasteners.

6. Provide for anchorage of type indicated, coordinated with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.

7. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware and similar items.

8. Fabricate joints which will be exposed to weather in a manner to exclude water or provide weep holes where water may accumulate.

C. Rough Hardware:

1. Provide all rough hardware required for installation of all metal fabrications. Rough hardware shall be as specified herein and as required by manufacturer and/or for complete installation.

2. Fabricate items of sized, shapes and dimensions required. Furnish malleable iron washers for heads and nuts which bear on wood structural connections; elsewhere, furnish steel washers.

3. Provide all rough hardware as required by manufacturer and/or for a complete installation.

D. Safety Nosings:

1. General:

a. Provide safety nosings at all exterior concrete steps. Fabricate from extruded aluminum with integral abrasive filler consisting of aluminum oxide, silicone carbide, or a combination of both, of color as selected by Architect from manufacturer’s standards. Furnish in lengths required to accurately fit full width of treads.

b. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.

1) If integral anchors are standard with manufacturer, provide non-continuous type.

2. Available Products:

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a. Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

1) “BF2", American Abrasive Metals Co.

2) “B722", Barry Pattern and Foundry Co., Inc.

3) “WP2J”, Wooster Products, Inc.

E. Ladders:

1. Fabricate ladders for locations shown, with dimensions, spacings, details and anchorages as indicated. Comply with requirements of ANSI A14.3.

a. Provide ½" x 2-1/2" continuous structural steel flat bar side rails with eased edges, spaced 18" apart.

b. Provide 3/4" diameter solid structural steel bard rungs at 12" O.C.

2. Fit rungs in centerline of side rails, plug weld and grind smooth on outer rail faces.

3. Support each ladder at top and bottom and at intermediate points spaced not more than 5'-0" O.C. Use welded or bolted steel brackets, designed for adequate support and anchorage, and to hold ladder clear of the wall surface with a minimum of 7" clearance from wall to centerline of rungs.

4. Extend rails 42" above top rung, and return rails to wall or structure unless other secure handholds are provided. If the adjacent structure does not extend above the top rung, goose-neck the extended rails back to the structure to provide secure ladder access.

5. Provide non-slip surface on top of each rung, either by coating the rung with aluminum oxide granules set in epoxy resin, or by using a type of manufactured rung which is filled with aluminum oxide grout.

F. Galvanizing:

1. Provide a zinc coating for those items indicated or specified to be galvanized, as follows:

a. ASTM A153 for galvanizing iron and steel hardware.

b. ASTM A123 for galvanizing rolled, pressed and forged steel shapes, plates, bars and strip 1/8" thick and heavier.

c. ASTM A386 for galvanizing assembled steel products.

G. Shop Painting:

1. Apply shop primer to surfaces of metal fabrications except those which are galvanized or as indicated to be embedded in concrete or masonry, and in

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compliance with requirements of SSPC-PA1 "Paint Application Specification No. 1" for shop painting.

2. Prepare ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:

   a. Exteriors (SSPC Zone 1B); SSPC-SP6 "Commercial Blast Cleaning".

   b. Interiors (SSPC Zone 1A); SSPC-SP3 "Power Tool Cleaning". PART 3 - EXECUTION

3.01 INSPECTION

A. The fabricator/installer shall examine the areas and conditions under which the metal fabrications are to be installed. Do not proceed until the unsatisfactory conditions have been corrected in an acceptable manner.

3.02 FABRICATION AND WORKMANSHIP

A. Materials of type, size and thickness shown shall be used, or if not shown, of required size and thickness to produce adequate strength and durability in the finished product. Metal surfaces shall be clean and free from mill scale, flake rust and rust pitting, well formed and finished to shape and size, with sharp lines and angles and smooth surfaces.

B. Exposed work shall be formed true to line and level with accurate angles and surfaces and straight sharp edges. Exposed edges shall be eased to a radius of 1/32" unless otherwise shown. Bent metal corners shall be formed to the smallest radius possible without causing grain separation, or otherwise impairing work.

C. All corners and seams shall be welded continuously, complying with AWS recommendations. At exposed connections, exposed welds shall be ground smooth and flush to match and blend with adjoining surfaces.

D. Castings shall be uniform quality, free from blowholes, porosity, hard spots, shrinkage distortion or other defects. Castings shall conform to the dimensions indicated with a tolerance of plus or minus 1/8", except in the dimensions of covers and the openings to receive them shall be limited to plus or minus 1/16". Castings shall be smooth and well cleaned by shot blasting or other approved methods. Covers subject to street or foot bearing surfaces; provide machined bearing or contact surfaces for other joints where indicated or required.

E. Shearing and punching shall leave clean, true lines and surfaces. Curved work shall be evenly sprung. Weld or rivet permanent connections. Welds and flush rivets shall be finished flush and smooth on surfaces that will be exposed after installation. Do not use screws or bolts where they can be avoided; where used, heads shall be countersunk, screwed up tight and threads stripped to prevent loosening. Finish products shall represent the best in workmanship.

F. Fastenings shall be concealed where practicable. Thickness of metal and details of assembly and supports shall give ample strength and stiffness. Exposed fasteners, where

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used, shall be of the type shown or, if not shown, Phillips flat-head (countersunk) screws or bolts shall be used.

G. Exposed connections shall be formed with hairline joints, flush and smooth, using concealed fasteners wherever possible. Joints exposed to weather shall be formed to exclude water. Provide holes and connections for the work of other trades.

H. Anchoring devices shall be fabricated and spaced to provide adequate support for the intended use.

I. Metal fabrications shall be cut, reinforced, drilled and tapped, as required, to receive finish hardware and similar items.

J. All steel fabrications to be installed in exterior locations (outside the building) shall be hot dipped galvanized after fabrication.

K. All metal fabrications, except galvanized steel, or members or portions of members to be imbedded in concrete or masonry surfaces and edges to be field welded, and galvanized surfaces unless otherwise specified, shall be shop painted with primer.

L. All scale, rust and other deleterious materials shall be removed before applying the shop primer or galvanizing. Heavy rust and loose mill scale shall be removed in accordance with SSPC SP-2 "Hand Tool Cleaning" or SSPC SP-7 "Brush-off Blast Cleaning." Oil, grease and similar contaminants shall be removed in accordance with SSPC SP-1 "Solvent Cleaning."

M. Immediately after surface preparation, galvanizing shall be applied or the shop primer shall be brushed or sprayed on in accordance with the manufacturer's instructions, and at a rate to provide a uniform dry film thickness of 3.0 miles for each coat. One coat shall be applied to fabricated metal items, except two (2) coats shall be applied to surfaces inaccessible after assembly or erection.

N. All miscellaneous metal items shall be erected into place as shown on the Drawings, and adjusted to satisfactorily fulfill the use for which such is intended.

O. All metal to be prepared for painting to comply with Section 09900.

3.03 INSTALLATION

A. At proper time, deliver and set in place items for miscellaneous metal fabrication work to be built into adjoining construction. Erect items which require field cutting, fitting, drilling or welding to structure.

B. Only experienced mechanics familiar with this particular type of work shall be employed. Installation work shall be performed in accordance with these Specifications and approved shop drawings. All shall be installed in a neat, precise, workmanlike manner.

C. Provide anchorage devices and fastenings where necessary for securing miscellaneous metal fabrications to in-place construction; including; threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other connectors as required.

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D. Perform cutting, drilling and fitting required for installation of miscellaneous metal fabrications. Set work accurately in location, alignment and elevation, plus, level, true and free of rack, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items which are to be built into concrete masonry or similar construction.

E. Weld connections which are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Grind exposed joints smooth and touch-up shop paint coat. Do not weld, cut or abrade the surfaces of exterior units which have been hot-dipped galvanized after fabrication, and are intended for bolted or screwed field connections.

F. For field welding, comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work.

G. Dissimilar Metals Coating:

1. All dissimilar metals coming in contact with each other shall be coated with asphaltic, bituminous, or otherwise protective paint to prevent chemical reaction.

H. Ladders: Install ladders to comply with all codes and regulations.

I. Safety Nosings: Install safety nosings to comply with manufacturer recommendations.

J. Gates: Install to comply with drawings and verify operation.

3.03 ADJUST AND CLEAN

A. All exposed surfaces shall be left clean and free from all blemishes or discolorations after erection.

B. Touch-Up Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting.

a. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

END OF SECTION 05500

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SECTION 05 50 01 - METAL FABRICATIONS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to the following metal fabrications:
   1. Miscellaneous metal fabrications
   2. Rough hardware
   3. Loose bearing and leveling plates
   4. Ladders
      a. Roof ladder
      b. Elevator pit ladder
   5. Ladder Fall Arrest System
   6. Countertop supports
   7. Low partition supports
   8. Steel pipe bollards
   9. Abrasive nosings
   10. Mop sink wall guard.
   11. Elevator pit sump covers

1.3 REFERENCE STANDARDS

A. AAMA 611 - Specification for Anodized Architectural Aluminum; 2026.

B. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

C. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

D. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

E. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 2008 (Reaffirmed 2018).

F. ASTM A27/A27M - Standard Specification for Steel Castings, Carbon, for General Application; 2020.

G. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

H. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).

I. ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2022.

J. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

K. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

L. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

M. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2026.

N. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2025.

O. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.

P. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.

Q. ASTM A312/A312M - Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes; 2025.

R. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.

S. ASTM A513/A513M - Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing; 2025.

T. ASTM A554 - Standard Specification for Welded Stainless Steel Mechanical Tubing; 2021.

U. ASTM A568/A568M - Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for; 2025a.

V. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

W. ASTM A741 - Standard Specification for Metallic-Coated Steel Wire Rope and Fittings for Highway Guardrail; 2011.

X. ASTM A743/A743M - Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application; 2021.

Y. ASTM A786/A786M - Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates; 2015 (Reapproved 2025).

Z. ASTM A793 - Standard Specification for Rolled Floor Plate, Stainless Steel; 1996.

AA. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.

BB. ASTM B26/B26M - Standard Specification for Aluminum-Alloy Sand Castings; 2018, with Editorial Revision.

CC. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

DD. ASTM B247 - Standard Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings; 2025.

EE. ASTM B308/B308M - Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles; 2020.

FF. ASTM B429/B429M - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube; 2020.

GG. ASTM B632/B632M - Standard Specification for Aluminum-Alloy Rolled Tread Plate; 2024.

HH. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

II. ASTM D1187/D1187M - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal; 1997 (Reapproved 2024).

JJ. ASTM E488/E488M - Standard Test Methods for Strength of Anchors in Concrete Elements; 2022.

KK. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs; 2022.

LL. ASTM F594 - Standard Specification for Stainless Steel Nuts; 2022.

MM. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength; 2020.

NN. MFMA-4 - Metal Framing Standards Publication; 2004.

OO. SSPC-PA 1 - Shop, Field, and Maintenance Coating of Metals; 2024.

PP. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

QQ. SSPC-SP 2 - Hand Tool Cleaning; 2024.

RR. SSPC-SP 3 - Power Tool Cleaning; 2024.

SS. AAMA 204 – Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.

TT. AAMA 606.1 – Voluntary Guide Specifications and Inspection Methods for Integral Color Anodic Finishes for Architectural Aluminum.

UU. AAMA 607.1 – Voluntary Guide Specification and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum.

VV. AAMA 608.1 – Voluntary Guide Specifications and Inspection Methods for Electrolytically Deposited Color Anodic Finishes for Architectural Aluminum.

WW. ASTM A283 – Carbon Steel Plates, Shapes, and Bars.

XX. ASTM A385 – Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip).

YY. ASTM A480 – Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip

ZZ. ASTM A501 – Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

AAA. ASTM A666 – Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

BBB. ASTM A747/A747M – Standard Specification for Steel Castings, Stainless, Precipitation Hardening

CCC. ASTM B26 – Standard Specification for Aluminum-Alloy Sand Castings.

DDD. ASTM B85 – Standard Specification for Aluminum-Alloy Die Castings.

EEE. ASTM B177 – Standard Guide for Engineering Chromium Electroplating.

FFF. ASTM B209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

GGG. ASTM B210 – Standard Specification for Aluminum-Alloy Drawn Seamless Tubes.

HHH. ASTM B211 – Standard Specification for Aluminum-Alloy Bar, Rod and Wire.

III. ASTM C1011/C1011M – Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.

JJJ. ASTM F1941 – Standard Specification for Electrodeposited Coatings on Mechanical Fasteners, Inch and Metric.

KKK. ANSI/ASSP Z359.16 – Safety Requirements for Climbing Ladder Fall Arrest Systems.

LLL. AWS – Standard Symbols for Welding, Brazing, Nondestructive Examination.

MMM. AWS – Structural Welding Code.

NNN. SSPC – Steel Structure Painting Council - Steel Structures Painting Council.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements, for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 – Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 – Product Requirements for substitution procedures.

C. Product data for products.

D. Shop drawings detailing fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other sections.

E. Samples representative of materials and finished products as may be requested by Architect.

F. Welder current certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.

G. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include a list of completed projects with project name, addresses, names of architects and owners, and other information specified.

H. Delegated-Design Submittal: Contractor shall engage a qualified professional engineer, licensed in the State of Florida, to design calculations, analysis data, and shop drawings - indicating compliance with dedicated design requirements, and signed and sealed by the qualified Florida registered professional engineer responsible for their preparation.

I. Deferred Submitals:
   1. Deferral of any submittal items shall have the prior approval of the building official. Documents for deferred submittal items shall be submitted to the Architect for review and approval, and shall then be submitted by the Contractor to the building official for review.
   2. The registered design professional in responsible charge shall list the deferred submittals on the construction documents for review by the building official. Florida Building Code [A] 107.3.4.1.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Firm experienced in producing metal fabrications similar to those indicated for this Project with a record of successful in-service performance, and with sufficient production capacity to produce required units without delaying the Work.

B. Welding Standards: Comply with applicable provisions of AWS "Structural Welding Code”
   1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone re-certification.

C. Inserts and Anchorages: Furnish inserts and anchoring devices which must be set in concrete or built into masonry for installation of miscellaneous metal work. Provide setting drawings, templates, instructions, and directions for installation of anchorage devices. Coordinate delivery with other work to avoid delay.

D. Shop Assembly: Pre-assemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for re-assembly and coordinated installation.

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1.7 PERFORMANCE REQUIREMENTS

A. Delegated-Design: Contractor shall engage a qualified professional engineer, licensed in the State of Florida, to design calculations, analysis data, and shop drawings - indicating compliance with dedicated design requirements, and signed and sealed by the qualified Florida registered professional engineer responsible for their preparation.

1.8 FIELD CONDITIONS

A. Field Measurements: Check actual locations of walls and other construction to which metal fabrications must fit by accurate field measurements before fabrication. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

B. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabricating products without field measurements. Coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions. Allow for trimming and fitting.

PART 2 PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: For metal fabrications exposed to view in the completed Work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

B. Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M, Grade C or D.

C. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.

D. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.

E. Zinc-Coated Steel Wire Rope: ASTM A741.

F. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
   1. Size of Channels: 1-5/8 by 1-5/8 inches (41 mm) and as indicated on drawings.
   2. Galvanized steel, ASTM A653, commercial steel, Type B or structural steel, Grade 33, with G90 coating; specify nominal thickness.

G. Material: Galvanized steel, ASTM A653/A653M.

H. Material: Cold-rolled steel, ASTM A1008/A1008M.

I. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.

2.3 STAINLESS STEEL

A. Stainless-Steel Sheet, Strip, and Plate: ASTM A240/A240M or ASTM A 666, Type 304, or Type 316L.

B. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304, or Type 316L.

C. Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M, Grade C or D.

D. Rolled-Stainless-Steel Floor Plate: ASTM A793.

2.4 ALUMINUM

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A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.

B. Aluminum Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 6061-T6.

C. Aluminum Extrusions: ASTM B221 (ASTM B 221M), Alloy 6063-T6.

D. Aluminum-Alloy Rolled Tread Plate: ASTM B632/B632M, Alloy 6061-T6.

E. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.

F. Extruded Structural Pipe Round Tubing: ASTM B429/B429M, Alloy 6063-T6. Provide Standard Weight (Schedule 40) pipe, unless otherwise indicated.

G. Drawn Seamless Tubing: ASTM B 210, Alloy 6063-T832.

H. Die and Hand Forgings: ASTM B247, Alloy 6061-T6.

2.5 ACCESSORIES

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for the metal alloy to be welded.

B. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A47, or cast steel, ASTM A27. Provide bolts, washers, and shims as required, hot-dip galvanized, ASTM A153.

2.6 PAINT

A. Shop Primer for Ferrous Metal:
   1. Exterior exposed steel scheduled to be painted if not galvanized: Tnemec Tneme-Zinc 90-97 or equal by Carboline or Ameron.
   2. Refer to Section 09 91 00, Painting, for primer for interior exposed steel scheduled to be painted.

B. Galvanizing Repair Paint: High-zinc-dust-content paint for re-galvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight and complying with DOD-P-21035 or SSPC-Paint 20.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M, formulated for 30-mil thickness per coat.

D. Coordinate standard shop primers normally provided with the finish paint specifications for these items in Painting specifications. Metal fabricator will be required to provide the primers as specified in Painting specifications. All items scheduled to receive finish coats as specified in Painting specifications shall be prepared for primer in accordance with SSPC - SP 6, Commercial Blast Cleaning, or SSPC-SP 3, Power Tool Cleaning, as recommended by the manufacturer for the types of primers installed.

2.7 FASTENERS AND ANCHORS

A. General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
   1. Provide stainless-steel fasteners for fastening aluminum.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F593; with hex nuts, ASTM F594; and, where indicated, flat washers; Alloy Group 2.

D. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.

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1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

E. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.

F. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

G. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, indicated with anchor straps or studs. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B633, Class Fe/Zn 5, as needed for fastening to inserts.

2.8 GROUT

A. Non-shrink, Nonmetallic Grout: Factory-packaged, non-staining, non-corrosive, nongaseous grout complying with ASTM C1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

B. Products: Subject to compliance with requirements, provide one of the following:
1. Sure-grip High Performance Grout; Dayton Superior Corp.
2. Five Star Grout; Five Star Products.
3. Masterflow 928 and 713; Master Builders Technologies, Inc.
4. Sealtight 588 Grout; W. R. Meadows, Inc.

2.9 CONCRETE FILL

A. Concrete Materials and Properties: Comply with requirements of specification section “Cast-in-Place Concrete,” for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi (20684.28 kPa), unless higher strengths are indicated.

2.10 FABRICATION

A. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.

B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

C. Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in the design, fabrication, and installation of installed metal assemblies to prevent buckling, opening up of joints, and overstressing of welds and fasteners. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss.
1. Temperature Change (Range): 100 degrees Fahrenheit (37.78 degrees Celsius).

D. Ease exposed edges to a radius of approximately 1/32 inch (0.79 mm), unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Weld corners and seams continuously to comply with the following:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.

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4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing, and contour of welded surface matches those adjacent.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

G. Provide for anchorage of type indicated, coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

H. Shop Assembly: Pre-assemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for re-assembly and coordinated installation.

I. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

J. Fabricate joints that will be exposed to weather in a manner to exclude water or provide weep holes where water may accumulate.

K. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

L. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (38 mm), with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches (203.2 mm) from ends and corners of units and 24 inches (609.6 mm) o.c., unless otherwise indicated.

2.11 MISCELLANEOUS METAL FABRICATIONS

A. Rough Hardware
1. Furnish bent, or otherwise custom-fabricated, bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Division 06 Sections.
2. Fabricate items to sizes, shapes, and dimensions required. Furnish malleable-iron washers for heads and nuts that bear on wood structural connections and furnish steel washers elsewhere.

B. Loose Bearing and Leveling Plates: Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of the required thickness and bearing area. Drill plates to receive anchor bolts and for grouting as required. Galvanize after fabrication.

2.12 LADDERS

A. Steel Ladders:
1. Fabricate ladders for the locations shown, with dimensions, spacings, details, and anchorages as indicated on Drawings.
2. Comply with requirements of ANSI A14.3 and OSHA.
3. Siderails: Continuous, steel, 1/2-by-2 1/2-inch flat bars or bent plate, with eased edges, spaced 18 inches (457.2 mm) apart.
4. Rungs: 3/4-inch- diameter steel bars, spaced 12 inches (304.8 mm) o.c.
5. Wall brackets 2” x 1/4' steel.
6. Fit rungs in centerline of side rails, plug weld and grind smooth on outer rail faces.
7. Support ladder at top and bottom and at intermediate points spaced not more than 5 feet (152.4 cm) o.c. with welded or bolted steel brackets.

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a. Size brackets to support design dead and live loads indicated per delegated design and to hold centerline of ladder rungs clear of the wall surface by not less than 7 inches (177.8 mm).

8. Provide non-slip surfaces on top of each rung, either by coating the rung with aluminum-oxide granules set in epoxy-resin adhesive, or by using a type of manufactured rung that is filled with aluminum-oxide grout.
9. Galvanize ladders:
   a. Exterior locations.
   b. Interior locations, where indicated.

2.13 LADDER FALL ARREST SYSTEM

A. Manufacturer and basis of design shall be the following. However, products of other manufacturers will be considered for acceptance, provided they equal or exceed the material requirements and functional qualities of the specified product, and acceptance is provided by the Architect in writing prior to bidding.
   1. Kattsafe: https://kattsafe.com
      a. Basis of Design Product: KATTCLIMB® Ladder Fall Arrest System.
   2. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Section 01 25 00.0 – Substitution Procedures regarding requirements of substitutions to be considered.

B. Use for interior and exterior roof access or related access locations where height exceeds 24-feet.

2.14 ELEVATOR PIT SUMP COVERS

A. Fabricate from 3/16-inch rolled-steel floor plate with four 1-inch diameter holes for water drainage and for lifting.

B. Fabricate from welded or pressure-locked steel bar grating Limit openings in gratings to no more than 1/2 inch in least dimension.

2.15 MISCELLANEOUS FRAMING AND SUPPORTS

A. Provide miscellaneous steel framing and supports for applications indicated that are not a part of structural steel framework as required to complete the Work.

B. Fabricate units to sizes, shapes, and profiles indicated and required to receive other adjacent construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.
   1. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed.
   2. Except as otherwise indicated, space anchors 24 inches (609.6 mm) o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches (32 mm) wide by 1/4 inch (6.35 mm) thick by 8 inches (203.2 mm) long.

2.16 COUNTERTOP SUPPORTS

A. Provide stainless steel countertop supports for wall mounted countertops from 14-gauge sheet steel. Provide a triangle brace with top horizontal length two thirds of countertop depth and vertical portion to be secured to wall to be one half of countertop length. Fold all edge with 1″ fold and all exposed edges to be hemmed. Supports shall be located at 30" o.c.

B. Surface mounted counter support brackets fabricated from 2” x 2” x 0.188” thick aluminum.
   1. Basis of Design Product: “Rakks EH-Inside Wall Mount Counter Support Bracket” as manufactured by Rangine Corporation.
      a. (CS-1) Model #EH-1212FM, 12” x 14” bracket, supports 430#.
      b. (CS-2) Model #EH-1818FM, 18” x 20” bracket, supports 300#.
      c. (CS-3) Model #EH-1824FM, 18” x 26” bracket, supports 300#.
   2. Finish: as selected by the Architect.

C. Hidden countertop brackets:
   1. Manufacturer and basis of design shall be the following. However, products of other manufacturers will be considered for acceptance, provided they equal or exceed the material requirements and functional qualities of the specified product, and acceptance is provided by the Architect in writing prior to bidding.
      a. Centerline Brackets.
         1) Basis of Design Product: “Hidden Countertop Supports”
            (a) (CS-4) Model #CSA-0008-12.

2.17 LOW PARTITION SUPPORTS

A. Support: Premanufactured low wall support fabricated with G90 galvanized support stud welded to 14” x 3 3/8” mounting plate. Assembly shall be G90 after fabrication.
   1. Height: Extend to with 2” of top of wall.
   2. Basis of Design Product: “Ponywall Support” as manufactured by Scafco Steel Stud Company

2.18 STEEL PIPE BOLLARDS

A. Fixed Bollards
   1. Bollards shall comply with ASTM F3016.
      a. Design bollard and foundation to withstand a 30-mph impact and requirements of applicable codes for a K4 rating.
   2. Fabricate 6” diameter pipe bollards, 48” above grade and 48” below grade or as indicated on drawings from Schedule 80 steel pipe. Fill bollards with concrete. Provide a rounded top.

2.19 ABRASIVE NOSINGS

A. Extruded Units: Aluminum units with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in lengths necessary to accurately fit openings or conditions.
   1. Basis of Design Product: 3" single part ribbed bar nosing, as manufactured by Nystrom.

B. The following manufacturer’s subject to compliance with requirements are accepted and equal or better performing products of other manufacturers will be considered for acceptance by the Architect.
   1. Balco, Inc.
   2. Wooster Products, Inc.

C. Apply clear lacquer to concealed surfaces of extruded units.

2.20 MOP SINK WALL GUARD

A. Provide custom fabricated 20-gauge stainless steel wall guard behind the mop sink.

B. Guard to start at top of mop sink and extend up wall to 36” above finished floor.

C. Guard shall be located on both walls behind the mop sink and extend 6” beyond edge of mop sink and extend down to top of wall base.

D. Edges shall have a 1/4" 10-degree brake.

2.21 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from structural steel shapes, plates, and bars of profiles shown with continuously welded joints, and smooth exposed edges. Miter corners and use concealed field splices wherever possible and grind welds smooth and finish flush where exposed to view.

B. Provide cutouts, fittings, and anchorages as required to coordinate assembly and installation with other work. Provide anchors, welded to trim, for embedding in concrete or masonry

construction, spaced not more than 6 inches (152.4 mm) from each end, 6 inches from corners, and 24 inches (609.6 mm) o.c., unless otherwise indicated.

C. Galvanize miscellaneous exterior steel trim and at indicated interior locations.
   1. Exterior locations.

2.22 MISCELLANEOUS ALUMINUM TRIM

A. Unless otherwise indicated, fabricate units from extruded aluminum shapes, plates, and bars of profiles shown with continuously welded joints, and smooth exposed edges. Miter corners and use concealed field splices wherever possible and grind welds smooth and finish flush when exposed to view.

B. Provide anchorages as required to coordinate assembly and installation with other work and if exposed approved by the Architect.

2.23 FINISHES – GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Sections shall be free of scratches and other serious surface blemishes and chemically cleaned.

B. Aluminum Surfaces: Sections shall be free of scratches and other serious surface blemishes and chemically cleaned.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Finish metal fabrications after assembly.

E. Finishes – Steel
   1. Prepare surfaces to be primed in accordance with SSPC-SP 2.
   2. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
   3. Do not prime surfaces in where field welding is required.
   4. Interior Steel Members: Prime paint items with one coat.
   5. Exterior Steel Members:
      a. Galvanize after fabrication to ASTM A123/A123M.
      b. Provide minimum G90 galvanized coating.
      c. Paint per specification sections Interior Painting and Exterior Painting.

F. Finishes – Aluminum
   1. Finish: To be selected by the Architect.
   2. Clear Anodic Finish: Class 1, AAMA 611, AA-M12C22A41, Mechanical finish, nonspecular as fabricated, chemical finish, 0.7 mils (0.01778 mm) or thicker.
   3. Colored Anodic Finish: Class 2, AAMA 611, AA-M12C22A32/A34, Mechanical finish, nonspecular as fabricated, integral colored, chemical finish, 0.4 mils (0.01016 mm) or thicker. Verify availability with manufacturers selected.
      a. Color: As selected by Architect.
   4. High-Performance Organic Finish Two-Coat Fluoropolymer: Chemical Finish Organic Coating, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight. Complying with paint manufacturer's written instructions for cleaning, preparing, pretreating and apply coating to exposed metal surfaces to comply with AAMA 2604.
      a. Color and Gloss: As selected by Architect from full range of industry colors and color densities.
   5. High-Performance Organic Finish Three-Coat Fluoropolymer: Chemical Finish Organic Coating, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride

resin by weight. Complying with paint manufacturer's written instructions for cleaning, preparing, pretreating and apply coating to exposed metal surfaces to comply with AAMA 2605.

a. Color and Gloss: As selected by Architect from full range of industry colors and color densities.

G. Finishes – Stainless Steel
1. Finish: #4 Satin

PART 3 EXECUTION

3.1 EXAMINATION

A. Installer must examine the areas and conditions under which miscellaneous and ornamental items are to be installed. Notify the Contractor in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.2 PREPARATION

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installing anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

B. Set sleeves in concrete with tops flush with finish surface elevations. Protect sleeves from water and concrete entry.

3.3 INSTALLATION

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.

D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop-welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units that have been hot-dip galvanized after fabrication and are intended for bolted or screwed field connections.

E. Field Welding: Comply with the following requirements:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing, and contour of welded surface matches those adjacent.

3.4 SETTING LOOSE PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of bearing plates.

B. Set loose leveling and bearing plates on wedges or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges

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or shims, but if protruding, cut off flush with the edge of the bearing plate before packing with grout.

1. Use non-shrink, metallic grout in concealed locations where not exposed to moisture; use non-shrink, nonmetallic grout in exposed locations, unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.5 INSTALLING LADDERS

A. CMU/Concrete Walls: Ladder to be attached directly to floor and wall.

B. Metal Stud Partitions: Ladder to be attached directly to floor and wall.

3.6 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for securely to, and rigidly brace from, building structure.

3.7 INSTALLING METAL PIPE BOLLARDS

A. Embedded Bollards:

1. Anchor bollards in concrete in formed or core-drilled holes not less than 8 inches deep and 3/4 inch larger than OD of bollard. Fill annular space around bollard solidly with non-shrink grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward bollard.
2. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.
3. Fill bollards solidly with concrete, mounding top surface to shed water.

3.8 INSTALLING NOSINGS

A. For nosings embedded in concrete steps or curbs, align nosings flush with riser faces and level with tread surfaces.

3.9 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a 2.0-mil minimum dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of the shop paint on miscellaneous metal is specified in Division 09 Section "Painting."

C. Touchup Painting: Clean and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal as is specified in Division 09 Painting Sections.

D. For galvanized surfaces, clean welds, bolted connections, and abraded areas, and apply galvanizing repair paint to comply with ASTM A780.

END OF SECTION

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SECTION 055100 **-** PRE-ENGINEERED METAL STAIRS

PART 1 – GENERAL

1.1 PROJECT INCLUDES

A. Metal Stairs, Ship Ladders and Landings.

B. Railings attached to metal stairs and Ships ladders.

C. Wall mounted railings

D. Shop coatings.

1.2 RELATED SECTIONS

A. Structural Steel: Section 051200

B. Cast in Place Concrete: Section 033000

1.3 REFERENCES

A. American Welding Society (AWS)

B. American Society for Testing and Materials (ASTM)

C. National Association of Architectural Metal Manufacturers (NAAMM)

1. MBG 531 - Metal Bar Grating Manual for Steel, Stainless Steel, and Aluminum Gratings and Stair Treads.

1.4 PERFORMANCE REQUIREMENTS

A. Design pre-engineered, prefabricated stairs, ship's ladders and landings to resist the following loads:

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1. Uniform load: 100 pounds per square foot of horizontal projection.
2. Stair treads: Specified uniform load or 300 pounds concentrated load applied to 4 square inches in the center of the tread, whichever produces the greater stress.
3. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch, whichever is less.

B. Design handrails, guardrails and gates to resist a concentrated load of 200 lbs.in any direction, and a uniform load of 50 lbs. per linear foot applied to the top rail in a vertical and a horizontal direction.

C. Design toe boards to conform to the requirements of CFR 1910.23.

1.5 SUBMITTALS

A. Shop Drawings

1. For each fabricated item include plans, elevations, and details. Show the following:

   a. Details of sections.
   b. Jointing and connections.
   c. Indicate welded connections using standard AWS symbols
   d. Reinforcing.
   e. Fasteners and anchors.
   f. Accessories.
   g. Location of each finish.

B. Product Data

1. Submit manufacturer's specifications, details, and installation instructions for:

   a. All manufactured products used in fabrications.
   b. Paints.
   c. Grouts.

C. Samples

1. Submit Samples of products and materials when requested.

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1.6 QUALITY ASSURANCE

A. Where fabrications are specified to comply with specific structural performance requirements, provide design sealed by a professional engineer registered in the state in which the project is located.

1.7 PROJECT CONDITIONS

A. Field Measurements

1. Take field measurements prior to preparation of Shop Drawings and fabrication where possible.

B. Coordination with Masonry and Concrete Work

1. Where fabricated items or their anchors are to be embedded into concrete and masonry work, deliver such items to those performing the installation.

PART 2 – PRODUCTS

2.1 MATERIALS - METALS

A. Steel Shapes:

1. Plates, bars, angles, channels, and H-sections: ASTM A36.
2. Bars for grating: ASTM A569 or ASTM A36.
3. Galvanizing: ASTM A123.
4. Tubing: ASTM A500 or A513.
5. Pipe: ASTM A53 (black steel and hot-dipped galvanized).

B. Steel Sheet:

1. For structural uses: Hot-rolled, ASTM A570.
2. For nonstructural uses: Hot-rolled, ASTM A569.

C. Galvanized Steel Sheet:

1. ASTM A653/A653M, thickness as specified in U.S. Standard gage, G90 coating designation, unless otherwise indicated.

2.2 MANUFACTURED COMPONENTS

A. Rolled Floor Plate: Complying with ASTM A786.

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B. Bar Gratings: Manufacture in accordance with "Standard Specifications for Metal Bar Grating and Metal Bar Grating Treads"

C. Abrasive Nosings and Treads: Aluminum with integral abrasive finish.

2.3 MATERIALS - MISCELLANEOUS

A. Nonshrink Grout

B. Concrete: Normal weight ready-mix concrete as specified in Division 3.

1. Minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

C. Concrete Inserts: Style as required for application.

D. Fasteners: Use fasteners suitable for the material being fastened and for the type of connection required.

E. Galvanizing Repair Paint: Zinc dust paint complying with SSPC-Paint 20, Type II, or DOD P-21035.

F. Primer for Iron and Steel shop coat and field touch-up.

2.4 FABRICATION

A. Provide pre-engineered, prefabricated steel stairs, ships ladders and landings.

B. Fabricate and shop-assemble in largest practical sections for delivery to site.

C. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated.

D. Mechanical Finishes: Complete finishing prior to fabrication wherever possible.

E. Fasteners: Use concealed fasteners wherever possible.

F. Anchors: Provide for anchorage of type indicated; use anchors of same material and finish as item except where specifically indicated otherwise.

G. Welding:

H. Joints Exposed to Weather: Fabricate to keep water out, or provide adequate drainage of water that penetrates.

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I. Sheet Metal: Form sheet metal corners with smallest possible radius without causing grain separation or otherwise impairing work.

J. Channel and Tube-Shaped Members: Provide welded closures for exposed ends.

K. Provide toeboards at open sides of platforms where stringer does not extend above floor level.

L. Where masonry walls support steel stairs, provide temporary support members as required to allow erection of stair before installation of masonry.

M. Steel Pan Treads, Risers, and Platforms:

N. Grating Treads and Platforms:

O. Floor Plate Treads and Platforms:

2.5 FABRICATION – RAILINGS

A. Railings - General: Construct as indicated.

B. Pipe and Tube Railings:

2.6 FABRICATION – GRATINGS

A. Bar Gratings:

2.7 FABRICATION - SHOP COATINGS

A. Galvanizing for Members Other than Sheet: Hot-dip galvanize after fabrication.

B. Shop-prime all iron and steel that is not galvanized.

C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements for SSPC surface-preparation specifications

D. Shop Priming: Apply primer in compliance with SSPC-PA 1.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Anchor to substrates indicated; provide all fasteners required.

B. Cut, drill, and fit items as required for installation.

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C. Do not weld, cut, or abrade galvanized surfaces of items galvanized after fabrication and indicated for bolted or screwed field connections.

D. Set items accurately in location, alignment, and elevation; level, true, and free of rack, measured from established lines and levels.

E. Provide temporary bracing as required.

F. Install manufactured components in accordance with manufacturer's instructions.

3.2 CLEANING AND TOUCH-UP

A. Touch up damage to galvanized surfaces using galvanizing repair paint in accordance with ASTM A 780.

B. Touch up shop paint immediately after erection.

END OF SECTION 055100

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SECTION 05 51 13 - METAL PAN STAIRS WITH INTEGRAL HANDRAILS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, materials, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Pre-assembled steel stair with concrete filled treads.
   2. Steel tube railings attached to metal stairs.

1.3 REFERENCE STANDARDS

A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

C. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).

D. ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2022.

E. ASTM A185/A185M - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete; 2007 Edition, September 1, 2007.

F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.

G. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.

H. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.

I. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.

J. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2025.

K. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

L. ASTM D1187/D1187M - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal; 1997 (Reapproved 2024).

M. ASTM E488/E488M - Standard Test Methods for Strength of Anchors in Concrete Elements; 2022.

N. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings; 2021.

O. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings; 2024.

P. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength; 2020.

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Q. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025, with Errata (2026).

R. NAAMM AMP 510 - Metal Stairs Manual; 1992.

S. SSPC-PA 1 - Shop, Field, and Maintenance Coating of Metals; 2024.

T. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

U. SSPC-SP 6/NACE No.3 - Commercial Blast Cleaning; 2006.

V. ASTM A48 – Standard Specification for Gray Iron Castings.

W. ASTM A53 – Standard Specification for Pipe, Black, and Hot-Dipped, Zinc-coated Welded and Seamless.

X. ASTM A325 – Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

Y. ASTM A500 – Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

Z. ASTM A501 – Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

AA. ASTM A563 – Standard Specification for Carbon and Alloy Steel Nuts.

BB. ASTM A652 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

CC. ASTM B663 – Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.

DD. ASTM D1187 – Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.

EE. AWS – Structural Welding Code.

FF. SSPC (Steel Structures Painting Council) – Steel Structures Painting Manual.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements, for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 - Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 - Product Requirements for substitution procedures.

C. Product Data: For metal pan stairs components.

D. Submit shop drawings detailing fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other Sections.

E. Samples: For each item and type of exposed finish required.

F. Delegated-Design Submittal: Submit design calculations, analysis data and shop drawings indicating compliance with dedicated design and performance requirements signed and sealed by the qualified Florida registered professional engineer responsible for their preparation.

G. Welder current certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.

H. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include a list of completed projects with project name, addresses, names of architects and owners, and other information specified.

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1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Firm experienced in producing metal fabrications similar to those indicated for this Project with a record of successful in-service performance, and with sufficient production capacity to produce required units without delaying the Work.

B. Manufacturer's Qualifications: Provide products from a firm that makes the indicated products as a regular production item and with not less than ten (10) years experience.

C. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation of specified materials and assemblies with not less than five (5) years experience.

D. Welding Standards: Comply with applicable provisions of AWS - "Structural Welding Code."

E. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone re-certification.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

B. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

C. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

D. Coordinate locations of hanger rods and struts with other work so that they do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.

1.8 PERFORMANCE REQUIREMENTS

A. Fabricate stair assembly to NAAMM - Metal Stairs Manual, Class Architectural.

B. Design shall include all member, supports and connections for fully functional stairs as indicated in the delegated design.

C. Structural Performance: Railings and stairs shall withstand the effects of gravity, horizontal, uniform, and concentrated loads and stresses indicated in applicable codes and shall the designated design.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
   1. Temperature Change: 120 degrees Fahrenheit (48.89 degrees Celsius), ambient; 180 degrees Fahrenheit (82.22 degrees Celsius), material surfaces.

E. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

F. Welding: Welders employed on the work shall perform all work in accordance with AWS standards.

G. Structural Performance: Stairs and railings, including attachment to building construction, shall withstand the effects of gravity loads and the loads and stresses within limits and under conditions indicated as indicated by applicable codes.

H. Delegated-Design: Provide delegated design services including calculations and shop drawings for load bearing items to comply with performance requirements, applicable code requirements and design criteria signed and sealed by an engineer registered in the State of Florida.

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PART 2 PRODUCTS

2.1 MANUFACTURER

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
   1. American Stair Corp.
   2. Sharon Stairs
   3. Alfab, Inc.

2.2 STEEL-FRAMED STAIRS

A. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," Commercial Class, unless more stringent requirements are indicated.

B. Stair Framing:
   1. Fabricate stringers of steel channels and provide closures for exposed ends of channel stringers.
   2. Construct platforms of steel channel headers and miscellaneous framing members as needed to comply with performance requirements.
   3. Weld stringers to headers; weld framing members to stringers and headers.
   4. Where stairs are enclosed by gypsum board assemblies, provide hanger rods or struts to support landings from floor construction above or below. Locate hanger rods and struts where they do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.
   5. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.

C. Metal Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements, but not less than 0.067 inch (1.7 mm).
   1. Steel Sheet: Uncoated cold-rolled steel sheet.
   2. Directly weld metal pans to stringers; locate welds on top of subtreads to be concealed by concrete fill. Do not weld risers to stringers.
   3. Shape metal pans to include nosing integral with riser.
   4. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.

D. Steel Tube Railings: Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.
   1. Handrails, Rails, and Posts: 1-1/4" pipe with 1.66" outside diameter.
   2. Picket Infill: 3/4-inch pipe with 1.05 inch (26.67 mm) outside diameter, pickets spaced 4 inches (101.6 mm) o.c.
   3. Lower Rails: 1-1/4" standard pipe with 1.66" outside diameter.

E. Railing Welded Connections: Fabricate railings with welded connections.

F. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
   1. For railings, provide ferrous-metal fittings, brackets, fasteners, and sleeves, except provide galvanized anchors embedded in exterior masonry and concrete construction.

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2. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 2 1/4-inch clearance from inside face of handrail to finished wall surface.
3. Fasteners for Interconnecting Railing Components: Provide concealed spigots and fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.

2.3 FASTENERS

A. Fasteners for anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
   1. Framer construction: Prepare backing plate for mounting in wall.
   2. Exposed Fasteners: Flush countersunk screws or bolts consistent with design of railing.

B. Fasteners for Interconnecting Railing Components:
   1. Provide concealed cast spigots and fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.

C. Bolts, Nuts, and Washers: ASTM A325 or A307.

D. Toggle Bolts: Tumble-wing type, FS-FF-B-588, type, class and style as required.

E. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

F. Post-Installed Anchors: Torque-controlled expansion anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.
   1. Carbon-steel components zinc plated to comply with ASTM B633, Class Fe/Zn 5, unless otherwise indicated.

2.4 MATERIALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Steel Pipe: To ASTM A53 Type E or S, Grade B.

D. Steel Tubing: ASTM A 500 (cold formed).

E. Uncoated, Cold-Rolled Steel Sheet: ASTM A1008/A1008M, structural steel, Grade 25, unless another grade is required by design loads; exposed.

F. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.

2.5 MISCELLANEOUS MATERIALS

A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
   1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M, formulated for 30-mil thickness per coat.

D. Concrete Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi (20684.28 kPa) unless otherwise indicated.

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E. Welded Wire Reinforcement: ASTM A185/A185M, 6 by 6 inches (152.4 mm), W1.4 by W1.4, unless otherwise indicated.

F. Welding Materials: AWS D1.1/D1.1M; type required for welded materials.

2.6 FABRICATION GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

B. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

C. Cut, drill, tap and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (0.79 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Form exposed work with accurate angles and surfaces and straight edges.

F. Weld Connections: Cope components at connections to provide close fit or use fittings design for this purpose. Weld all around at connections including fitting.
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. Weld exposed corners and seams continuously unless otherwise indicated.
   5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 2 welds: partially dressed weld with spatter removed.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.

2.7 RAILING FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads. Railings shall be fabricated by one manufacture.

B. Welded Connections: Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

C. Form changes in direction of railings by bending or by inserting prefabricated elbow fittings.
   1. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

D. Close exposed ends of railing members with prefabricated end fittings.

E. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch (6.35 mm) or less.

F. Connect posts to stair framing by direct welding unless otherwise indicated.

G. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.

1. For railings, provide ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.
2. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 2 1/4-inch clearance from inside face of handrail to finished wall surface.

H. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Shop Assembly: Pre-assemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for re-assembly and coordinated installation.

K. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.8 FINISH

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Preparation for Shop Priming Stairs: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No.3, "Commercial Blast Cleaning." minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed products.

C. Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel", for shop painting.

D. Provide exposed fasteners and brackets with a finish matching appearance matching the railings, unless indicated otherwise.

E. Baked-Enamel or Powder-Coated Finish: AAMA 2604 except with a minimum dry film thickness of 1.5 mils (0.0381 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSPECTION

A. Examine the areas and conditions under which metal stair items are to be installed. Do not proceed with the Work until unsatisfactory conditions have been corrected.

3.3 PREPARATION

A. Furnish setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, anchor bolts, and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

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3.4 INSTALLING METAL PAN STAIRS

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.

D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

E. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

F. Place and finish concrete fill for treads and platforms to comply with Specification Section "Cast-in-Place Concrete."

G. Provide structural hanger rod supports to structure for support of landings as required.

3.5 INSTALLING RAILINGS

A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with post-installed anchors and bolts.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

C. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.

D. Attach handrails to wall with wall brackets. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as follows:
   1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
   2. For hollow masonry anchorage, use toggle bolts.
   3. For wood stud partitions, use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry work to locate backing members.
   4. For steel-framed partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with stud installation to locate backing members.
   5. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.
   6. For steel-framed partitions, use toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

E. Set posts plumb within a tolerance of 1/16 inch (1.59 mm) in 3 feet (91.44 cm).

F. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch (6.35 mm) in 12 feet (365.76 cm).

G. Corrosion Protection: Coat concealed surfaces that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

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H. Adjust railings before anchoring to ensure matching alignment at abutting joints.

I. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

J. Fit exposed connections together to form tight, hairline joints.

K. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

L. Do not store handrails at jobsite.

3.6 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

B. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

C. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Painting Specification Section.

D. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION

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SECTION 05 52 13 - PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Aluminum pipe tube railings and accessories.

1.3 REFERENCE STANDARDS

A. AAMA 611 - Specification for Anodized Architectural Aluminum; 2026.

B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

C. ASTM B247 - Standard Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings; 2025.

D. ASTM B429/B429M - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube; 2020.

E. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

F. ASTM D1187/D1187M - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal; 1997 (Reapproved 2024).

G. ASTM E488/E488M - Standard Test Methods for Strength of Anchors in Concrete Elements; 2022.

H. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings; 2021.

I. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings; 2024.

J. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs; 2022.

K. ASTM F594 - Standard Specification for Stainless Steel Nuts; 2022.

L. ASTM B209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

M. ASTM B210 – Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes.

N. ASTM B241/A241M – Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.

O. ASTM B483 – Standard Specification for Aluminum and Aluminum and Aluminum-Alloy Drawn Tubes for General Purpose Applications.

P. AAMA 607.1 – Voluntary Guide Specification and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum.

Q. AWS – Structural Welding Code.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements, for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

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1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 - Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 - Product Requirements for substitution procedures.

C. Product Data: For the railings, brackets and items indicated.

D. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

E. Samples: For each type of exposed finish required.

F. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
   1. Fittings and brackets.
   2. Indicate method of connecting members at intersections.

G. Assembled sample of railing system, made from full-size components, including handrail. Sample need not be full height.
   1. Show connection of members at intersections.

H. Delegated-Design Submittal: Submit design calculations, analysis data and shop drawings indicating compliance with dedicated design and performance requirements signed and sealed by the qualified Florida registered professional engineer responsible for their preparation.

I. Welder current certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.

J. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include a list of completed projects with project name, addresses, names of architects and owners, and other information specified.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Firm experienced in producing metal fabrications similar to those indicated for this Project with a record of successful in-service performance, and with sufficient production capacity to produce required units without delaying the Work.

B. Welding Standards: Comply with applicable provisions of AWS - "Structural Welding Code."

C. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone re-certification.

1.7 MOCKUP

A. Provide a non-installed mockup consisting of a complete 4’-0” long full height section consisting of a mounting post, intermediate post, linear railing members, handrails, top rails, balusters, attached fittings and bracket all in the finish required.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

B. Coordination installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.9 PERFORMANCE REQUIREMENTS

A. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on performance requirements.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

C. Temperature Change: 120 deg. F, ambient; 180 deg. F, material surfaces.

D. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

E. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity, horizontal, uniform and concentrated loads, and stresses within limits and under conditions indicated as indicated by applicable codes.

F. Delegated-Design: Provide delegated design services including calculations and shop drawings for railings and load bearing items to comply with performance requirements, applicable code requirements and design criteria signed and sealed by an engineer registered in the State of Florida.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
   1. Petersen Metals
   2. Tri Tech Handrails
   3. Tuttle, A Dant Clayton Division

2.2 ALUMINUM RAILING

A. Pipe Railings: Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of pipe, post spacings, and anchorage, but not less than that needed to withstand design loads.
   1. Handrails, Rails, and Posts: 1-1/4" standard pipe with 1.66" outside diameter.
   2. Picket Infill: 1/2-inch 0.083” thick minimum round pickets spaced 4 inches (101.6 mm) o.c.
   3. Lower Rails: 1-1/4" standard pipe with 1.66" outside diameter.
   4. Vertical Rails: 1 ¼” standard pipe with 1.66” outside diameter
   5. Perforated Metal Infill: As selected by the Architect from materials as manufactured by McNichols Co.

B. Railing Welded Connections: Fabricate railings with welded connections.

C. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
   1. For railings, provide cast aluminum fittings, t-brackets, escutcheons, wall brackets, fasteners, and sleeves.
   2. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 2-1/4-inch clearance from inside face of handrail to finished wall surface.
   3. Fasteners for Interconnecting Railing Components: Provide concealed spigots and fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.

2.3 FASTENERS

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A. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
   1. Frame construction: Prepare backing plate for mounting in wall.
   2. Exposed Fasteners: Flush countersunk screws or bolts consistent with design of railing.

B. Bolts, Nuts, and Washers: Type 304 stainless steel.

C. Toggle Bolts: Type 304 stainless steel.

D. Anchor Bolts: Type 304 stainless steel.

E. Post-Installed Torque-controlled Anchors: Torque-controlled expansion anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.
   1. Interior: Carbon-steel components zinc plated to comply with ASTM B633, Class Fe/Zn 5, unless otherwise indicated.
   2. Exterior: Alloy stainless-steel bolts, ASTM F593 (ASTM F 738M), and nuts, ASTM F594 (ASTM F 836M).

F. Provide adjustable brackets and flanges, with aluminum inserts for casting in concrete where indicated.

2.4 MATERIALS

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Extruded Bars Tubing: ASTM B221, Alloy 6063-T5/T52.

C. Extruded Structural Pipe Round Tubing: ASTM B429/B429M, Alloy 6063-T6.
   1. Provide Standard Weight (Schedule 40) pipe minimum, unless otherwise indicated.

D. Drawn Seamless Tubing: ASTM B 210, Alloy 6063-T832.

E. Plate and Sheet: ASTM B 209, Alloy 6061-T6.

F. Die and Hand Forgings: ASTM B247, Alloy 6061-T6.

G. Brackets, Flanges and Anchors: Cast or formed metal of same type of material and finish as supported rails unless indicated otherwise.

H. Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.

2.5 MISCELLANEOUS MATERIALS

A. Welding Materials: AWS type required for welded materials, provide metal type as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

B. Non-shrink, Nonmetallic Grout: Factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M, formulated for 30-mil thickness per coat.

D. Aluminum to Steel Isolation Gaskets: Provide #15 asphalt impregnated felt gaskets between aluminum to steel bolted connections. Trim gasket tight to mounting base plate.

2.6 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads. Railings shall be fabricated by one manufacture.

B. Shop Assembly: Pre-assemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for re-assembly and coordinated installation.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (0.79 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Welded Connections: Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove flux immediately.
   4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
   5. Form changes in directions by bending or utilizing prefabricated elbow fittings
   6. Connect members where required with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

F. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

G. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

H. Close exposed ends of railing members with prefabricated end fittings.

I. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch (6.35 mm) or less.

J. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.

K. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers, or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

L. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 2 1/4-inch clearance from inside face of handrail to finished wall surface.

M. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage and space devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

N. Fillers: Provide fillers made from plate material, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

O. Fabricate system to accommodate railing anchor plates.

2.7 FINISH

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A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Sections shall be free of scratches and other serious surface blemishes and chemically cleaned.

B. Aluminum Surfaces: Sections shall be free of scratches and other serious surface blemishes and chemically cleaned.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Provide exposed fasteners and brackets with a finish matching the railings, unless indicated otherwise.

E. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

F. Exterior Clear Anodic Finish: Class I, AA-M12C22A41, Mechanical Finish, nonspecular as fabricated Chemical Finish, etched Anodic Coating, clear coating 0.07mil or thicker complying with AAMA 611. Complying with paint manufacturer's written instructions for cleaning, preparing, pretreating and apply coating to exposed metal surfaces.

G. Interior Clear Anodic Finish: Class II, AA-M12C22A31 Mechanical Finish, nonspecular as fabricated Chemical Finish, etched Anodic Coating, clear coating 0.04mil or thicker complying with AAMA 611. Complying with paint manufacturer's written instructions for cleaning, preparing, pretreating and apply coating to exposed metal surfaces.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
   1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
   2. Set posts plumb within a tolerance of 1/16 inch (1.59 mm) in 3 feet (91.44 cm).
   3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch (6.35 mm) in 12 feet (365.76 cm).

C. Corrosion Protection: Coat concealed surfaces that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 ANCHORING POSTS

A. Form or core-drill holes not less than 5 inches (127 mm) deep and 3/4 inch (19.05 mm) larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with non-shrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

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3.4 ATTACHING RAILINGS

A. Attach railings to wall with wall brackets, except where end flanges are used. Provide brackets with 2 1/4-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

B. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
   1. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

C. Secure wall brackets and railing end flanges to building construction as follows:
   1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.

3.5 ADJUSTING AND CLEANING

A. Clean by washing thoroughly with clean water and soap and rinsing with clean water.

3.6 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION

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SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Sheathing.

B. Preservative treated wood materials.

C. Concealed wood blocking, nailers, and supports.

D. Miscellaneous wood nailers, furring, and grounds.

1.3 REFERENCE STANDARDS

A. ANSI/AWC PWF - Permanent Wood Foundation Design Specification; 2021.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

D. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

E. ALSC (American Lumber Standards Committee) – Softwood Lumber Standards.

F. EWA (The Engineered Wood Association).

G. APA (American Plywood Association).

H. AWPA U1 – Use Category System - User Specification for Treated Wood.

I. AWPA P5 – Standard for Waterborne Preservatives.

J. ICC-ES Standards.

K. ICC-ES AC380 - Acceptance Criteria for Termite Physical Barrier Systems; 2021, with Editorial Revision (2022).

L. PS 1 - Structural Plywood; 2023.

M. PS 2 - Performance Standard for Wood Structural Panels; 2018.

N. PS 20 - American Softwood Lumber Standard; 2025.

1.4 REFERENCES:

A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 – Administrative Requirements for submittal requirements.

B. Refer to Section 01 60 00.0 – Product Requirements for substitution procedures.

C. Product Data: Provide technical data on insulated sheathing, wood preservative materials, and application instructions.

D. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

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1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

E. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

F. Evaluation Reports: For the following, from ICC-ES:
1. Wood-preservative-treated wood.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.7 FIELD CONDITIONS

A. Examine substrates and supporting structure and the conditions under which work is to be installed. Do not proceed with the installation until unsatisfactory conditions have been corrected.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.
1. For lumber and plywood pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.
2. Keep treated wood waste separated from other wood to be recycled or reused as mulch. Discard in a legal manor.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
1. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
2. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

B. Lumber fabricated from old growth timber is not permitted.

C. Fire retardant wood (FRTW) is NOT PERMITTED in FDOE SREF projects in accordance with FBC -Building Section 453.11. Concealed blocking can be pressure treated.

2.2 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. General:
1. Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including blocking, nailers, and similar items.
2. Lumber for blocking may be any grade and classified standard and better for western species or classified No. 2 for Southern Pine SPIB. Plywood shall not be used for blocking materials.
3. Provide lumber for support or attachment of other construction including rooftop equipment curbs and support bases, grounds, and similar members.

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4. Fabricate miscellaneous lumber from dimension lumber of sizes indicated and into shapes shown.
5. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
6. Wood grounds, nailers, and sleepers shall be pressure treated as specified herein. The manufacturer and applicator of pressure treatment shall mark all wood.
7. No wood grounds, nailers, blocking and sleepers shall be permitted inside the building, unless indicated otherwise.

B. Sizes: Nominal sizes as indicated on drawings, S4S.

C. Moisture Content: S-dry or MC19.

D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
1. Lumber: S4S, No. 2 or Standard Grade.
2. Boards: Standard or No. 3.

2.3 PLYWOOD PANELS

A. Equipment Backing Plywood Panels:
1. Comply with PS 1 "U.S. Product Standard for Construction and Industrial Plywood" for plywood construction panels, and for products not manufactured under PS 1 provisions, with APA PRP-108 trademark. Furnish construction panels that are each factory-marked with APA trademark.

B. Roof Sheathing: PS 2 type, rated Structural I Sheathing.
1. Bond Classification: Exterior.
2. Span Rating: 60.
3. Performance Category: 3/4 PERF CAT.
4. Exterior AC plywood thickness: As indicated on Drawings.

C. Other Applications:
1. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.
2. Plywood Exposed to View But Not Exposed to Weather: PS 1, A-D, or better.
3. Other Locations: PS 1, C-D Plugged or better.

2.4 ACCESSORIES

A. Metal and Finish of Fasteners:
1. Preservative-Treated Wood:
a. Fasteners in permanent wood foundations:
1) Type 304 stainless steel.
2) Comply with ANSI/AWC PWF.
3) For chromated copper arsenate (CCA) used in locations that will remain at less than 19 percent moisture content in service such as interior wood studs, interior blocking, and top plates of interior walls: Hot-dip galvanized steel complying with ASTM A153/A153M, Class D.
4) Do not permit galvanized parts to contact stainless steel.
b. Nails, timber rivets, wood screws, and lag screws - general use: Hot-dip galvanized steel complying with ASTM A153/A153M Class D.
1) Exception: See fasteners for permanent wood foundation.
2. Untreated Wood: Unfinished steel.

B. Anchors:
1. Toggle bolt type for anchorage to hollow masonry.
2. Expansion shield and lag bolt type for anchorage to solid masonry or concrete.
3. Boilt or ballistic fastener for anchorage to steel.

C. Die-Stamped Connectors: Hot dipped galvanized steel, sized to suit framing conditions.
   1. For contact with preservative treated wood in exposed locations, provide minimum G185 (Z550) galvanizing complying with ASTM A653/A653M.

D. Termite-Resistant Sill Plate Barrier: Self-adhesive, film-backed barrier with release sheet; adheres to concrete substrates and blocks termite access.
   1. Thickness: 68 mil, 0.068 inch (1.7 mm).
   2. Termite Resistance: 100 percent when tested in accordance with ICC-ES AC380.
   3. Water Vapor Permeance: 0.035 perm (2 ng/(Pa s sq m)), maximum, when tested in accordance with ASTM E96/E96M.

E. Termite-Resistant Sill Flashing: Self-adhesive membrane; polyethylene film bonded to sealant.
   1. Thickness: 40 mil, 0.040 inch (1 mm).
   2. Termite Resistance: 100 percent when tested in accordance with ICC-ES AC380.
   3. Water Vapor Permeance: 0.035 perm (2 ng/(Pa s sq m)), maximum, when tested in accordance with ASTM E96/E96M.

PART 3 EXECUTION

3.1 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

D. Protect treated wood from the weather. Store according to the manufacturer's recommendations.

3.2 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to authorities having jurisdiction may be used in lieu of solid wood blocking.

C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

F. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.

G. Install permanent grounds of dressed, preservative treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material involved. Remove temporary grounds when no longer required.

H. Provide nonstructural framing and blocking to support the following:
   1. Cabinets and shelf supports.
   2. Wall brackets.
   3. Handrails.
   4. Grab bars.

5. Towel and bath accessories.
6. Wall-mounted door stops.
7. Chalkboards and marker boards.
8. Wall paneling and trim.
9. Joints of rigid wall coverings that occur between studs.
10. Other wall- or ceiling-mounted items indicated on drawings.

3.3 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

B. Provide wood curb at each roof opening except where prefabricated curbs are specified and where specifically indicated otherwise; form corners by alternating lapping side members.

3.4 INSTALLATION OF CONSTRUCTION PANELS

A. Screw attach to metal decking with #10 self-tapping, galvanized deck screws.

B. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.
1. At long edges use sheathing clips where joints occur between roof framing members.
2. At long edges provide solid edge blocking where joints occur between roof framing members.
3. Nail panels to framing; staples are not permitted.

C. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches (610 mm) on center on all edges and into studs in field of board.
1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
3. Install adjacent boards without gaps.
4. Size: 48 by 96 inches (2440 by 4880 mm), installed horizontally at ceiling height.

3.5 SITE-APPLIED WOOD TREATMENT

A. Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.

B. Allow preservative to dry prior to erecting members.

3.6 TOLERANCES

A. Framing Members: 1/4 inch (6 mm) from true position, maximum.

B. Surface Flatness of Floor: 1/8 inch in 10 feet (1 mm/m) maximum, and 1/4 inch in 30 feet (7 mm in 10 m) maximum.

C. Variation from Plane, Other than Floors: 1/4 inch in 10 feet (2 mm/m) maximum, and 1/4 inch in 30 feet (7 mm in 10 m) maximum.

3.7 CLEANING

A. Comply with applicable regulations.

B. Do not burn scrap on project site.

C. Do not burn scraps that have been pressure treated.

D. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

E. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.

F. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

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SECTION 06 20 00 - FINISH CARPENTRY

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Shop finishing.

B. Miscellaneous plastic laminate clad items (PL-1, PL-2, PL-3).

1.3 REFERENCE STANDARDS

A. ANSI A135.4 - American National Standard for Basic Hardboard; 2004.

B. ANSI A208.1 - American National Standard for Particleboard; 2022.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

D. AWI (QCP) - Quality Certification Program; Current Edition.

E. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2024.

F. NHLA G-101 - Rules for the Measurement and Inspection of Hardwood and Cypress; 2023.

G. PS 1 - Structural Plywood; 2023.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with plumbing rough-in, electrical rough-in, and installation of associated and adjacent components.

B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.6 SUBMITTALS

A. Refer to Section 01 30 00.0 - Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 – Product Requirements for substitution procedures.

C. Product Data:
   1. Provide manufacturer's product data, storage and handling instructions for factory-fabricated units.
   2. Provide instructions for attachment hardware and finish hardware.

D. Samples: Submit two samples of each species of specified wood trim.

E. Product certificates signed by woodwork manufacturer certifying that products comply with specified requirements.

F. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.

G. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664 and AWPA C27B.

H. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.7 QUALITY ASSURANCE

A. Grade materials in accordance with the following:
   1. Softwood Lumber: In accordance with rules certified by ALSC; www.alsc.org.
   2. Plywood: Certified by the American Plywood Association.
   3. Hardwood Lumber: In accordance with NHLA Grading Rules; www.natlhardwood.org.

B. Quality Standards: Except as otherwise shown or specified, comply with specified provisions of the Architectural Woodwork Institute (AWI) "Quality Standards."

C. Optimum Moisture Content: Kiln-dry woodwork to an average moisture content within the following ranges or as otherwise recommended by applicable Quality Standards for the regional climatic conditions involved.
   1. Interior woodwork – 5 to 10 percent.
   2. Exterior woodwork – 19 percent maximum.

D. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
   1. Company with at least one project within the past 5 years with value of woodwork within 20 percent of cost of woodwork for this project.

E. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum three years of documented experience.

1.8 MOCK-UPS

A. Mock-up: Construct a freestanding combined mock-up that includes various elements of the exterior envelope. Refer to Section 01 40 00 and the Drawings for required elements and scope.
   1. Provide (section title) and accessories as required for the mock-up/s.
   2. The mock-up will not remain as part of the work.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-fabricated units to project site in original packages, containers or bundles bearing brand name and identification.

B. Store finish carpentry items under cover, elevated above grade, and in a dry, well-ventilated area not exposed to heat or sunlight.

C. Protect from moisture damage.

D. Handle materials and products to prevent damage to edges, ends, or surfaces.

1.10 WARRANTY

A. Correct defective Work within a one year period after Date of Substantial Completion.

B. Provide five year manufacturer warranty for _____.

PART 2 PRODUCTS

2.1 GENERAL

A. Fire retardant wood (FRTW) is NOT PERMITTED in FDOE SREF projects: FBC - Building Section 453.11. Concealed blocking can be pressure treated.

2.2 FINISH CARPENTRY ITEMS

A. Quality Standard:Unless otherwise indicated provide products of quality specified by AWI Architectural Woodwork Quality Standards Illustrated for Custom grade.

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B. Surface Burning Characteristics: Provide materials having fire and smoke properties as required by applicable code.

2.3 LUMBER MATERIALS

A. Lumber fabricated from old growth timber is not permitted.

B. Hardwood Lumber: ash species, quarter sawn, maximum moisture content of 6 percent; with vertical grain, of quality suitable for transparent finish.
   1. Finish: Shop finish clear lacquer.
   2. Grading: In accordance with NHLA G-101 Grading Rules; www.nhla.com.
      a. Grade: A.

C. Interior Material
   1. General: Provide materials that comply with requirements of the AWI Woodworking Standard for each type of woodwork and quality grade indicated and, where the following products are part of woodwork, with requirements of the referenced product standards, that apply to product characteristics indicated:
   2. Softwood Plywood: PS 1.
   3. Hardwood Plywood and Face Veneers: HPVA HP-1.
   4. Lumber: PS 20.
   5. High Pressure Laminate: NEMA LD3.
   6. Formaldehyde Emission Levels: Comply with formaldehyde emission requirements of each voluntary standard referenced below:
      a. Hardwood Plywood: HPMA FE

2.4 MISCELLANEOUS LAMINATE CLAD ITEMS (PL-1, PL-2, PL-3)

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
   1. Formica Corporation: www.formica.com
   2. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
      a. Laminart.
      b. Nevamar Corp.
      c. Pioneer Plastics Corp.
      d. Arborite, Forbo.
      e. Wilsonart.

B. Color/Finish: Refer to "Finish Color Summary Chart" on Drawings for product selections.

C. Laminate clad casework shall comply with custom grade quality standards as set forth in AWI, Section 400, Division 400B, "Laminate Clad Cabinets."

D. High Pressure Plastic Laminate (for miscellaneous millwork and paneling items).
   1. Plastic laminate except backing or balancing sheets shall be high pressure laminate conforming to NEMA LD-1985. Color shall be selected by the Architect from the full line of standard colors.
   2. Exposed Horizontal Surfaces: Shall be nominal .048 inch thick minimum with textured finish and conforming to NEMA standards for HGS horizontal grade.
   3. Exposed and Semi-Exposed, Interior and Exterior Vertical Surfaces: Shall be .028 inch thick minimum with low lustre textured finish and conforming to NEMA standards for VGS vertical grade.
   4. Backing Sheet for Concealed Surfaces: Shall be .028 or .020 inches thick, conforming to NEMA standards for VGS vertical grade or CL20 cabinet liner.

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5. Backing Sheet for Semi-Exposed Surfaces: Shall be .028 inches thick, conforming to NEMA standards for VGS vertical grade. Use to balance face laminate.
6. Paneling (Plastic Laminate on Plywood): Shall be .048 conforming to HGS for face and all exposed edges.

2.5 SHEET MATERIALS

A. Softwood Plywood, Not Exposed to View: Any face species, medium density fiberboard core; PS 1 Grade A-B, glue type as recommended for application.

B. Softwood Plywood, Exposed to View: Face species as indicated, plain sawn, medium density fiberboard core; PS 1 Grade A-B, glue type as recommended for application.
   1. Grading: Certified by the American Plywood Association.

2.6 ADHESIVE

A. Multipurpose Construction Adhesive: Formulation complying with ASTM D 3498 that is recommended for indicated use by adhesive manufacturer.
   1. Low-Emitting Materials: Adhesives shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.7 FASTENINGS

A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.

B. Adhesive for factory-fabricated units: Manufacturer's recommended adhesive for application.

C. Fasteners: Of size and type to suit application; black oxide finish in concealed locations and stainless steel finish in exposed locations.

D. Concealed Joint Fasteners: Threaded steel.

E. Fasteners for wood paneling and trim cap: Philips type, oval head, stainless steel #10 wood countersunk screws.

F. Concealed cleat fastening: Aluminum extruded paired cleats - 1/4" thick.

2.8 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.

B. Lumber for Shimming, Blocking, and support: Softwood lumber of any species.

C. Edge Trim: As indicated on Drawings.

D. Primer: Alkyd primer sealer.

2.9 FABRICATION

A. Shop assemble work for delivery to site, permitting passage through building openings.

B. Shop prepare and identify components for book match grain matching during site erection.

C. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

D. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs. (Locate counter butt joints minimum 600 mm from sink cut-outs.)

E. Apply laminate backing sheet to reverse face of plastic laminate finished surfaces.

2.10 SHOP FINISHING

A. Sand work smooth and set exposed nails and screws.

B. Apply wood filler in exposed nail and screw indentations.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Coordinate backing requirements for all paneling and trim.

C. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.2 INSTALLATION

A. Set and secure materials and components in place, plumb and level.

B. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch (0.79 mm). Do not use additional overlay trim to conceal larger gaps.

3.3 PREPARATION FOR SITE FINISHING

A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.

B. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials.

3.4 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch (1.6 mm).

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch (0.79 mm).

END OF SECTION

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SECTION 06 41 16 - PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES:

A. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Plastic-laminate-faced architectural cabinets (PL-1, PL-2, PL-3).

1.3 REFERENCE STANDARDS

A. Plywood Product Standards: Comply with PS 1 (ANSI A199.1) or, for products not manufactured under PS 1 provisions, with applicable APA Performance Standard PRP-108 for type of panel indicated.

B. ANSI/APA (American National Standards Institute/American Plywood Association).

C. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

D. AWI – Quality Standards.

E. BHMA A156.9 – Cabinet Hardware.

F. FED MMM-A-130 – Adhesive, Contact.

G. NEMA (National Electric Manufacturer's Association) LD3 – High Pressure Decorative Laminates.

H. PS 1 – Construction and Industrial Hardwood.

I. PS 20 – American Softwood Lumber Standard.

J. Voluntary Product Standards PS 20-70.

K. Grading rules of Southern Pine.

L. FSC – Forestry Stewardship Council.

M. SFI – Sustainable Forestry Initiative.

N. AMTF – American Tree Farm System.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements, for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 DEFINITIONS

A. Refer to Section 01 42 16 – Definitions, for the following terms:
   1. Exposed Portions of Casework.
   2. Semi-Exposed Portions of Casework
   3. Concealed Portions of Casework.

1.6 SUBMITTALS

A. Refer to Section 01 30 00.0 - Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 - Product Requirements for substitution procedures.

C. Product Data: For each type of product indicated including cabinet hardware and accessories and finishing materials and processes.

D. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

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1. Indicate quality grade, materials, species, construction, sizes, shapes, quantities, locations, and conditions of adjoining work.
2. Indicate items in related or dimensional position with sections or details shown either full size or 3" = 1'-0" scale.
3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
4. Show locations and sizes of cutouts and holes for electrical switches and outlets and other items installed in architectural plastic-laminate cabinets.

E. Samples for Initial Selection:
1. Plastic laminates and materials.
2. Accessories.

F. Manufacturers: Submit manufacturer's documentation substantiating the requirements for each type of materials as indicated:
1. Provide Letter of Certification(s) for Sustainable Forestry from one of the following:
2. Forestry Stewardship Council – (FSC)
3. Sustainable Forestry Initiative – (SFI)
4. American Tree Farm System – (AMTF)
5. Provide letter of certification signed by lumber supplier. Indicating compliance with organization requirements and identify certifying organization.
6. Submit organization certification numbers; identify each certified product on a line-item basis.
7. Submit copies of invoices bearing the organization certification numbers.

G. Manufacturers: Submit manufacturer's documentation substantiating the requirements for each type of materials as indicated:
1. Provide Letter of Certification(s) for Sustainable Forestry.
2. Forest Stewardship Council (FSC): Provide letter of certification signed by lumber supplier. Indicate compliance with FSC “Principles for Natural Forest Management” and identify certifying organization.
3. Submit FSC certification numbers; identify each certified product on a line-item basis.
4. Submit copies of invoices bearing the FSC certification numbers.

H. Manufacturer’s fully assembled cabinet must be GREENGUARD GOLD certified.

I. Qualification Data: For fabricator.

J. Product Certificates: For each type of product, signed by product manufacturer.

K. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturers with at least five (5) years experience making the specified materials as a current catalog and regular production item. Manufacturer shall employ skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance and is a certified participant in AWI's Quality Certification Program.

B. Installer Qualifications: Employ only experienced Installers skilled in the successful installation of the specified materials and assemblies on similar projects for a minimum of five (5) years and are certified participant in AWI's Quality Certification Program.

C. Source Limitations: Provide products of the same manufacturer for all cabinets.

D. Fire Hazard Classification: Comply with required NFPA, ANSI, and UL surface burning characteristics for plastic laminates, lumber, and plywood.

E. All cabinets shall comply with AWI’s Woodwork Quality Standards for grades of interior architectural woodwork, construction, finishes and other requirements.

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1. Provide AWS Certificate with shop drawings indicating that the woodwork complies with the requirements of the grades specified.

1.8 PERFORMANCE REQUIREMENTS

A. Manufacturers shall have independently tested their products and be able to submit documentation of results indicating compliance with AWI Performance Duty Level 3 as a minimum for structural performance.

1.9 MOCK-UP

A. Submit a sample of the cabinet, if the sample deviates from the specification and Design Criteria in any way, the Contractor must submit a substitution request. If the product is comparable to the specification, the Contractor must submit a comparable product request.

B. Sample does not have to be full scale but large enough to display all the materials listed in this standard to include: fronts, tops, backs, sides laminate, shelf, pulls, slides, backing, rails, hinges, base, doors and drawers.

C. The sample may be an on-site mockup and may be used as part of work upon Architect approval.

1.10 PRE-INSTALLATION MEETING

A. The Contractor shall conduct a pre-installation meeting at the project site a minimum of 30 days prior to any work being installed as indicated in this section and other related sections that require coordination with this section.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.12 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. All cabinets shall be manufactured in a climate-controlled environment, stored after fabrication in a climate controlled (temperature and humidity) storage area and shipped to the jobsite in an enclosed container (semi-tractor trailer).

C. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

D. Coordinate work with plumbing, mechanical, electrical, and other trades for rough-in work and installation of adjacent and associated components.

E. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.

F. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

G. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that cabinets can be supported and installed as indicated.

1.13 WARRANTY

A. Cabinet Manufacturer shall warrant all casework products against manufacturing defects in materials and workmanship for a period of five (5) years.

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B. Manufacturer shall warrant against structural failure of the cabinet body for a period of ten (10) years.

C. Installers Warranty: The installer shall warrant the entire installation against defects in material and workmanship for a period of one (1) years.

D. Duration of all warranties shall begin on the date of Substantial Completion.

E. Products will be repaired or replaced by Manufacturer, without cost to the Owner.

PART 2 PRODUCTS

2.1 P-LAM MANUFACTURERS

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
   1. Formica: www.formica.com

B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
   1. Wilsonart International.
   2. Nevamar.

2.2 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS (PL-1, PL-2, PL-3)

A. Basis of Design Products: Refer to "Finish Color Summary Chart" on Drawings for product selections.

B. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.
   1. Provide certificates from AWI certification program indicating that woodwork, including installation, complies with requirements of grades specified.
   2. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.

C. Fire retardant wood (FRTW) is NOT PERMITTED in FDOE SREF projects: FBC - Building Section 453.11. Concealed blocking can be pressure treated.

D. Grade: Custom

E. Type of Construction: Frameless.

F. Cabinet, Door, and Drawer Front Interface Style: Flush overlay.

G. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.
   1. Laminate Cladding for Exposed Surfaces:
      a. Horizontal Surfaces: Grade HGS (.048) - Horizontal Grade, High Pressure Decorative Laminate.
      b. Post-Formed Surfaces: Grade HGP (.042) - Post Forming.
      c. Vertical Surfaces: Grade VGS (.028) - Vertical Grade, High Pressure Decorative Laminate.
      d. Concealed Backing: Grade BKH (.028) - High Pressure Backer.
      e. Cabinet Liner: Grade CLS (.020) - High Pressure Cabinet Liner.
   2. Materials for Semi-Exposed Surfaces:
      a. Surfaces not specifically indicated: High-pressure decorative laminate, NEMA LD 3, Grade CLS.
      b. Concealed Backing: Grade BKH (.028) - High Pressure Backer.

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c. Cabinet Liner: Grade CLS (.020) - High Pressure Cabinet Liner.
d. For semi-exposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade CLS.

3. Dust Panels: 1/4-inch plywood or tempered hardboard above compartments and drawers unless located directly under tops
4. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.
5. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces as selected by Architect from laminate manufacturer's full range in the following categories.
   a. Solid colors.
   b. Wood grains.
   c. Patterns.
   d. Finish Types
6. Edges: PVC edge binding 0.12” thick.

H. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
   1. Wood Moisture Content: 5 to 10 percent.

I. Core Material:
   1. Provide millwork or casework plywood cores of hardwood plywood “Veneer Core” Grade AA, with no-added-Urea Formaldehyde adhesives.
      a. Use 3/4" thick, closed-grain hardwood plywood typical unless noted otherwise.
      b. Use 1/4" thick hardwood plywood at indicated locations.
   2. Marine Grade Plywood: 3/4" specially designed panel made entirely of Douglas-fir or Western Larch. The grade of all plies of veneer is B or better. Exposure rating is Exterior and the glue used is a fully waterproof structural adhesive. Marine grade plywood shall be used for sink cabinets bases. Marine grade plywood shall be used at countertops and backsplashes within 3’-0” of sink areas.
   3. Hardwood plywood, 1/4', 1/2" thick or as indicated, Grade AA, HPVA HP-1 formaldehyde free, water resistant exterior glue.
   4. Lumber: Solid wood hardwood, 1/2”, 3/4" or as indicated kiln-dried, select Poplar, Fir or Grade III mill option.

2.3 MISCELLANEOUS MATERIALS

A. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

B. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, treated softwood lumber kiln dried to less than 15 percent moisture content.

C. Adhesives: Do not use adhesives that contain urea formaldehyde. Water based low Volatile Organic Compound (VOC) Non-toxic, PVA adhesive.

D. Glazing: Provide clear, tempered glass for glazed doors and openings in cabinetwork, 1/4" thick unless otherwise indicated, or approved.

2.4 HARDWARE

A. Finish Hardware Items: Provide following items of finish hardware with millwork.
   1. Drawer Glides: No. 8400 Extension Slides by Knape & Vogt Mfg. Co.
      a. Equal products to Knape & Vogt produced by Accuride and Blum are acceptable.
   2. Shelf Standards and Supports (recessed in cabinets): No. 255 Standard and No. 256 Supports by Knape & Vogt Mfg. Co., Natural aluminum finish.
      a. Equal products to Knape & Vogt produced by Accuride and Blum are acceptable.

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3. Doors: 1 pair heavy-duty institutional hinges, Stanley HT1592, US28.
   a. 1 catch, Stanley 41 Series.
   b. 1 pull, Stanley 4483, US28.
   c. Equal products to Stanley produced by Grant and Hettich America are acceptable.
4. Drawer Pulls: Stanley 4483, US28. Equal products to Stanley produced by Grant and Hettich America are acceptable.
5. Drawer Locks: Schlage CL 888R or Olympus 888IC cabinet drawer lock, US26D, complete with strike plate.
   a. Provide locks with Interchangeable Core Schlage cylinders keyed to the existing Facility Master Key System as directed by Owner.
6. Door Locks: Schlage CL 777R or Olympus 777IC cabinet door lock, US26D, complete with strike plate.
   a. Provide locks with Interchangeable Core Schlage cylinders keyed to the existing Facility Master Key System as directed by Owner.
   b. Provide one elbow catch per pair doors.
7. Cabinet locks keyed to the facility shall be coordinated with the Hardware Supplier of section 08 71 00 who shall provide the locks.
8. Master key:
   a. Master key doors and drawers of cabinetry in each room with each other and the main entrance room door.
   b. Use a Schlage Everest D245 or Schlage 1456 restricted keyway as directed by owner.
   c. Equal products to Schlage produced by Olympus are acceptable.
9. Silencers: Use neoprene type with self-adhesive at all cabinet doors.
10. Door Catches: Provide heavy duty, spring loaded, large 11/16" diameter roller mounted catch at bottom edge of door. All doors over 48" in height shall have top and bottom catches. At double doors provide cast aluminum “Ives #2 Elbow Catch” at inactive leaf. Pull chains not permitted. At wardrobe cabinets provide fixed shelf at center of unit for catch mounting.
11. Chain Stops: Provide at doors that open towards other finished materials, equipment or building components such as existing and future appliances, walls and other cabinets. Provide 12” long chain with 1-1/2" x 1" attachment plates at either end. Install near top of cabinet door so the door will not open beyond 90 degrees and less if required so the door handle will not hit adjacent surfaces.

B. Finish: As selected by the Architect.

2.5 FABRICATION

A. General:
   1. All exposed cabinet edges shall be beveled or rounded to prevent sharp edges or corners.

B. Fabrication Workmanship:
   1. Construct millwork items in accordance with specified quality grade of reference standards, except as otherwise specified or detailed.
   2. Construct millwork items using materials specified for plastic laminate finish.

C. Milling:
   1. Fabricate and assemble work at mill as complete as practicable.
   2. Deliver ready to assemble and set in place.
   3. Machine sand all work at mill and deliver free of machine or tool marks or defects that will show through finish.

D. Provide plastic laminate finish on all exposed surfaces of doors, drawers, countertops, splashes, etc. of cabinets unless noted otherwise.

E. Countertops and Backsplashes:
   1. See drawings and specifications for additional types of countertops.
   2. Countertops: 3/4" plywood 1-1/2" thick edge and with high pressure plastic laminate.

3. Backsplashes: 3/4" plywood with high pressure plastic laminate.
4. Provide 3/4" thick marine grade plywood in within 3’-0” of sinks.
5. Provide 1" radius at exposed corners.

F. Base: 4- inch high, 3/4" pressure treated plywood or lumber.

G. Body: 3/4" plywood.
1. Tops, bottoms, and sides to be glued and paneled.
2. High Pressure Plastic Laminate.
3. Provide 3/4" thick marine grade plywood for body where sinks are located.

H. Cabinet Backs: Cabinet back shall be 1/2" plywood and shall be fully bound (dadoed) into sides, top and bottom, recessed 7/8" from the cabinet rear. Rear, unexposed side of back shall be toe-nailed to cabinet body with mechanical fasteners and solidified with a continuous bead of industrial grade hot melt adhesive to withstand a bond test as described in ANSI/WDMA I.W.1A. All cabinet backs shall have a minimum of two plywood laminate clad flush mounting blocks (hang rails).

I. Hang rails shall be 3/4" x 4” high plywood and located at rear of cabinet back and on the inside and fastened to cabinet sides. Provide 2 hang rails at wall cabinet, 1 hang rail at base cabinet and three hang rails at tall cabinets.

J. Doors: 3/4" plywood up to 36” wide and/or high and 1” thick over 36” wide and/or 36” high.
1. Front and Back: High Pressure Laminate.

K. Shelving: 3/4" plywood, maximum 36" unsupported width, 1” for shelves over 36’ wide up to 48” wide.
1. Top and Bottom: High pressure laminate.
2. Provide 1" radius at exposed corners in open shelving.
3. Shelves shall be full depth.

L. Drawer:
1. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
2. Join sub-fronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners.
3. Front: 3/4" plywood with high pressure laminate face with cabinet liner on the back.
4. Bottom: 1/4", plywood fully bound (dadoed) into front, sides and back laminated with cabinet liner.
5. Sides and back: 1/2" thick hardwood plywood.

M. Body, Door, Drawer, and Shelves Edges
1. Edges: PVC edge band.

N. Dust Panels: 1/4-inch plywood above compartments and drawers unless located directly under tops.

O. Construction Tolerances
1. Gap between doors, drawers, panels and frames shall be 1/8".

P. Fabricate cabinets to dimensions, profiles, and details indicated.

Q. Plastic laminate shall be applied to the top of all tall cabinets and scribed to wall.

R. Finish Hardware: Fit drawer guides and cabinet-mounted shelf standards at mill.
1. Ship other finish hardware items loose for installation at job site.

S. Glazing: Install glazing at mill to the greatest extent practical.
1. Field glazing shall be with dry type glazing gaskets sized to eliminate gaps and prevent loose glazing installations.

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T. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

U. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

2.6 ENVIRONMENTAL

A. Products: Not less than 50 percent (by cost) of wood-based materials shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

B. Forest Stewardship Council (FSC): Provide letter of certification signed by lumber supplier. Indicate compliance with FSC “Principles for Natural Forest Management” and identify certifying organization.

C. Certification: Submit FSC certification numbers, identify each certified product on a line-item basis.

D. Ureaformaldehyde: No ureaformaldehyde products shall be added or allowed in any products.

E. Adhesives: For adhesives, including printed statement of VOC content.

F. Composite Wood: For composite-wood products, documentation indicating that product contains no urea formaldehyde.

G. Multipurpose Construction Adhesive: Formulation complying with ASTM D3498 that is recommended for indicated use by adhesive manufacturer.

H. Use adhesive that has a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

I. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
   1. Wood Glues: 30 g/L.
   2. Contact Adhesive: 250 g/L.

J. Adhesives: Use adhesives that meet the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

K. Adhesives: Adhesive for or site installation or factory fabrication. Submit manufacture’s documentation substantiating the following requirements for each type of materials provided per this specification.

L. Submit manufacturer’s certification that products comply with VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

M. Submit manufacturer's product data for adhesives. Indicate VOC limits of the product. Submit MSDS highlighting VOC limits.

N. Submit Green Seal Certification to GS-36 and description of the basis of certification.

O. Submit manufacturer's certification that products comply with SCAQMD #1168. Submit manufacturer's certification that products comply with SCAQMD Rule 1168 inch (29667.2 mm) areas where exposure to freeze/thaw conditions and direct exposure to moisture will not occur. In areas where freeze/thaw conditions do exist or direct exposure to moisture can occur, submit manufacturer's certification that products comply with Bay Area AQMD Reg. 8, Rule 51 for containers larger than 16 oz with California Air Resources Board (CARB) for containers 16 oz or less.

P. All cabinet work shall comply with California Standard 93120 with regard to formaldehyde levels.

PART 3 EXECUTION

3.1 PREPARATION

A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.

B. Before installing cabinets, examine shop-fabricated work for completion and complete work as required.

C. Examine surfaces for conditions that would prevent quality installation of millwork.

D. Verify that grounds and blocking are in place to support millwork.

E. Do not install on defective conditions, doing so shall indicate acceptance of site conditions and require you to correct any defects.

3.2 INSTALLATION

A. Do not start installation until the building is enclosed and the HVAC system controls the temperature and humidity (75 degrees, 55 RH) in the room space.

B. Erect the cabinets plumb, level, true and straight with no distortions. Countertops shall be installed to with-in 1/8-inch of level in a 10-foot length.

C. All cabinet faces shall be plumb and true from door face to door face. There shall be no side hanging or non-plumb doors. Seams shall be flush.

D. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.

E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
   1. Use filler matching finish of items being installed.

F. Install cabinets without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

G. Install cabinets with no more than 1/8 inch (3.18 mm) in 120-inch (0.12 inch (3 mm) in 2400-mm) sag, bow, or other variation from a straight line.

H. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches (406.4 mm) o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

I. Caulk all cabinets and countertops to adjacent wall surfaces.

J. Accurately scribe and fit scribe strips, trim strips, and filler panels to irregularities of adjacent surfaces, maximum gap opening 0.025". Plastic laminate overlay trim shall not be used to close caps.

K. Secure cabinets permanently to floor using anchors spaced at maximum of 30" o.c., minimum of two for each unit while maintaining 3/4" clearance between the back of cabinet and the exterior wall.

L. Bolt adjoining cases together, maximum width of joints 1/32".

M. Fasten tops to bases with screws driven through base cabinet top frame into bottom of countertop.

N. Scribe all backsplashes and aprons and caulk.

O. Blocking, Bucks, and Nailers: Install plumb, level and true with joints flush, fastened securely in place.

P. Furring and Stripping: Install plumb and level, shim to provide true finish surface.

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Q. Install color-matched sealant at unfinished joints with other materials.

R. Install wall-shelving standards on solid backing or with toggle bolts into steel studs or masonry or TEK screws into concrete.
   1. Do not install wall-shelving standards into gypsum wallboard only.
   2. Space standards as required to support indicated loading but not less than 5-plf based on shelf material provided.

S. Do not install cabinetry or millwork closer than 24" to ceilings in fully sprinklered buildings or such that installation obstructs any fire sprinkler head.

T. Glazing: Field glazing shall be with dry type glazing gaskets sized to eliminate gaps and prevent loose glazing installations.

3.3 SPECIAL INSTALLATION PROCEDURE / ADJUSTMENT PROCEDURES

A. Provide all items and accessories as required for a total and complete installation in every respect.

B. Proceed with installation only after unsatisfactory conditions have been corrected. Installation of any items indicates all conditions are satisfactory and acceptance of previous Work by other Contractors.

C. Adjust cabinets and hardware so that doors and drawers operate smoothly.

3.4 CLEANING

A. All modular cabinet surfaces shall be cleaned of construction spoils, dirt, spills, dust, and stains. The modular cabinet manufacturer shall recommend cleaning solvent. Clean all surfaces, edges, and cabinet interiors.

B. Remove and dispose of all packing materials and related construction debris.

C. Protection: Protect casework from damage during construction until date of Substantial Completion, replace damaged work.

END OF SECTION

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SECTION 07 01 50.19 - PREPARATION FOR RE-ROOFING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Removal of existing roofing system in preparation for new roofing system in designated areas as indicated on drawings.

B. Partial replacement of existing roofing system in preparation for replacement roofing system in designated areas as indicated on drawings.

C. Removal of existing flashing and counterflashings.

D. Temporary roofing protection.

1.3 REFERENCE STANDARDS

A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).

B. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.

C. ASTM C1153 - Standard Practice for Location of Wet Insulation in Roofing Systems Using Infrared Imaging; 2023.

D. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2017.

E. ASTM C1278/C1278M - Standard Specification for Fiber-Reinforced Gypsum Panel; 2017.

F. ASTM D41/D41M - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing; 2011 (Reapproved 2023).

G. ASTM D312/D312M - Standard Specification for Asphalt Used in Roofing; 2016a (Reapproved 2023).

H. ASTM D2178/D2178M - Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing; 2015a (Reapproved 2021).

I. ASTM D4601/D4601M - Standard Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing; 2004 (Reapproved 2020).

J. PS 1 - Structural Plywood; 2023.

K. PS 2 - Performance Standard for Wood Structural Panels; 2018.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with affected mechanical and electrical work associated with roof penetrations.

B. Preinstallation Meeting: Convene one week before starting work of this section.
   1. Attendees:
      a. Architect.
      b. Construction Manager.
      c. Owner.
      d. Installer.

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e. Roofing system manufacturer's field representative.
f. Inspection and Testing Agency Representatives.

2. Meeting Agenda: Provide agenda to participants prior to meeting in preparation for discussions on the following:
   a. Removal and installation schedule.
   b. Necessary preparatory work.
   c. Protection before, during, and after roofing system installation.
   d. Removal of existing roofing system.
   e. Installation of new roofing system.
   f. Temporary roofing and daily terminations.
   g. Transitions and connection to and with other work.
   h. Inspections and testing of installed systems.

C. Schedule work to coincide with commencement of installation of new roofing system.

1.6 SUBMITTALS

A. Refer to Section 01 30 00.0 - Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 - Product Requirements for substitution procedures.

C. Product Data: Submit for each type of material.

D. Shop Drawings: Indicate size, configuration, and installation details.

E. Preconstruction Test Reports.

F. Materials Removal Company Qualification Statement.

G. Installer's Qualification Statement.

H. Preconstruction Testing Agency Qualification Statement.

1.7 QUALITY ASSURANCE

A. Materials Removal Company Qualifications: Company specializing in performing work of type specified with at least three years of documented experience.
   1. Comply with EPA notification regulations prior to start of roofing removal work.
   2. Comply with removal and disposal regulations of local authorities having jurisdiction (AHJ).

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.
   1. When same installer as new roofing system, comply with related requirements of section indicated for new roofing system.
   2. Approved by existing roofing system warrantor to work on existing warranted roof system.

C. Preconstruction Testing: Conduct testing by an independent test agency, in accordance with provisions of Section 01 40 00 - Quality Requirements.
   1. Infrared Roof Moisture Survey: Conduct ground-based, walk-over type survey of roofing system in accordance with ASTM C1153.
      a. Conduct survey using non-destructive testing (NDT) procedures.
   2. Submit report of roofing survey including thermal images of suspect roof areas and corresponding daytime photos of these same areas.
   3. Provide required testing to locate hazardous materials, such as asbestos, by licensed agency as required for project location.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.

1.9 FIELD CONDITIONS

A. Existing Roofing System: metal roofing.

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B. Do not remove existing roofing membrane when weather conditions threaten the integrity of building contents or intended continued occupancy.

C. Maintain continuous temporary protection prior to and during installation of new roofing system.

D. Provide notice at least three days before starting activities that will affect normal building operations.

E. Verify that occupants have been evacuated from building areas when work on structurally impaired roof decking is scheduled to begin.

F. Owner will occupy building areas directly below re-roofing area.
   1. Provide Owner with at least 48 hours written notice of roofing activities that may affect their operations and to allow them to prepare for upcoming activities as necessary.
   2. Do not disrupt Owner's operations or activities.
   3. Maintain access of Owner's personnel to corridors, existing walkways, and adjacent buildings.

1.10 WARRANTY

A. Existing Warranties: Perform this work using methods and materials that will maintain existing roof system warranties.
   1. Notify existing roof system warrantor prior to starting this work and obtain written instructions for procedures necessary to maintain this existing warranty.
   2. Upon completion of this work, notify warrantor of reroofing completion and obtain documentation to verify that existing roofing system has been inspected and warranty is still in effect.
      a. Submit documentation upon project closeout.

PART 2 PRODUCTS

2.1 MATERIALS

A. Patching Materials: Provide necessary materials in accordance with requirements of existing roofing system.

B. Temporary Roofing Protection Materials:
   1. Construction Manager's responsibility to select appropriate materials for temporary protection of roofing areas as determined necessary for this work.

C. Roofing Recover Materials:
   1. Construction Manager's responsibility to select appropriate materials for roofing re-cover as determined necessary for this work.

2.2 ACCESSORIES

A. Fasteners: Type and size as required and compatible with existing and new roofing system to resist local wind uplift.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that existing roof surface has been cleared of materials being removed from existing roofing system and ready for next phase of work as required.

3.2 PREPARATION

A. Sweep roof surface clean of loose matter.

B. Remove loose refuse and dispose of properly off-site.

3.3 MATERIAL REMOVAL

A. Remove only existing roofing materials that can be replaced with new materials as the weather will permit.

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B. Repair existing roof deck surface to provide smooth working surface for new roof system.

3.4 FIELD QUALITY CONTROL

A. Inspection firm will identify the exact limits to material removal.

B. Testing will identify the condition of existing materials and their reuse, repair or removal.

C. Test Reports: Indicate existing insulation moisture content and existing bitumen quality.

3.5 PROTECTION

A. Provide protection of existing roofing system that is not having work performed on it.

B. Provide temporary protective sheeting over uncovered deck surfaces.

C. Turn sheeting up and over parapets and curbing. Retain sheeting in position with weights.

D. Provide for surface drainage from sheeting to existing drainage facilities.

E. Do not permit traffic over unprotected or repaired deck surface.

END OF SECTION

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SECTION 07 05 53 - FIRE AND SMOKE ASSEMBLY IDENTIFICATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Identification markings for fire and smoke rated partitions, and fire rated walls.

1.3 REFERENCE STANDARDS

A. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 – Administrative Requirements for submittal requirements.

B. Refer to Section 01 60 00.0 – Product Requirements for substitution procedures.

C. Product Data: Manufacturer's printed product literature for each type of marking, indicating font, foreground and background colors, wording, and overall dimensions.

D. Schedule: Completely define scope of proposed marking, and indicate location of affected walls and partitions, and number of markings.

E. Samples: Submit two samples of each type of marking proposed for use, of size similar to that required for project, illustrating font, wording, and method of application.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project site in original packaging.

B. Store products under cover and elevated above grade.

1.8 PROJECT CONDITIONS

A. Do not install adhered markings when ambient temperature is lower than recommended by label or sign manufacturer.

B. Do not install painted markings when ambient temperature is lower than recommended by coating manufacturer.

1.9 WARRANTY

A. Correct defective Work within a one year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.1 FIRE AND SMOKE ASSEMBLY IDENTIFICATION

A. Regulatory Requirements: Comply with marking and identification requirements of fire-resistance ratings and fire tests in accordance with regulations under Authorities Having Jurisdiction (AHJ).

B. Adhered Fire and Smoke Assembly Identification Signs: Printed vinyl or paper sign with factory applied adhesive backing.

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C. Applied Fire and Smoke Assembly Identification: Identification markings applied to partition with paint and a code compliant stencil. See Section 09 91 23 for products.

D. Languages: Provide sign markings in English.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.2 PREPARATION

A. See Section 09 91 23 for substrate preparation for painted markings.

3.3 INSTALLATION

A. Locate markings as required by FBC.

B. Install adhered markings in accordance with manufacturer's instructions.

C. Install applied markings in accordance with Section 09 91 23.

D. Install neatly, with horizontal edges level.

E. Protect from damage until Date of Substantial Completion; repair or replace damaged markings.

END OF SECTION

SECTION 07 11 13 - BITUMINOUS DAMPPROOFING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, SpecificationsSpecifications and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Application of an emulsion-type liquid-applied dampproofing membrane.

B. Surface preparation.

1.3 REFERENCE STANDARDS

A. ASTM C1193 - Standard Guide for Use of Joint Sealants, 2025.

B. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating, 2023.

C. ASTM D4263 - Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method, 1983 (Reapproved 2018).

D. ASTM D1187/D1187M – Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal, 1997 (Reapproved 2024).

E. ASTM D1227/D1227M – Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing, 2013 (Reapproved 2024).

F. ASTM D1668/D1668M – Standard Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing, 1997a (Reapproved 2021).

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements, for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 – Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 – Product Requirements for substitution procedures.

C. Submit manufacturer's product data and application instructions.

D. Product Data: Submit manufacturer's printed product data. Include the following information:
   1. Application locations.
   2. Application instructions; Application thickness, coverage, etc.

E. Certification: Submit manufacturer's certification that material meets requirements as specified and required for use intended.

1.6 QUALITY ASSURANCE

A. Manufacturer: Damp-proofing materials shall be provided by a company with a minimum of ten (10) years successful experience in the manufacture of damp-proofing products designed for the intended use as indicated herein.

B. Applicator: Application of damp-proofing materials shall be by a company with a minimum of five (5) years successful experience in the application of the required products. The applicator shall only use experienced personnel trained in the proper installation of the products as recommended and approved by the manufacturer.

1.7 MOCK-UP

A. Mockups: Build mockups to set quality standards for materials and execution.

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B. Build integrated mockups of exterior wall assembly, 150 sq. ft. incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application and sealing of gaps, terminations, and penetrations of assembly.

C. Coordinate construction of mockups to permit inspection and testing of before external insulation and cladding are installed.

D. Include junction at building corner condition and foundation wall intersection.

E. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.

F. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

G. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 PRE-INSTALLATION MEETING

A. The Contractor shall conduct a pre-installation meeting at the project site a minimum of 30 days prior to any work being installed as indicated in this section and other related sections that require coordination with this section.

B. Review bituminous dampproofing requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

1.9 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying company name, product name and number, and marked for location of application..
   1. Include a copy of manufacturer's complete installation instructions with each product.

B. Store materials under cover or otherwise protected from the elements. Prevent exposure to moisture, heat, or other harmful conditions.
   1. Store materials in a clean, dry area in accordance with manufacturer's instructions.
   2. Store at temperatures of 40 degrees Fahrenheit (4.44 degrees Celsius) and above to facilitate handling.
   3. Do not store dampproofing at temperatures above 90 degrees Fahrenheit (32.22 degrees Celsius) for extended periods.
   4. Keep away from sparks and flames.

C. Protect materials during handling and application to prevent damage or contamination.

D. Handle materials in accordance with manufacturer's recommendations. Damaged or improperly handled materials shall be replaced at no additional cost.

1.10 FIELD CONDITIONS

A. Product is not intended for uses subject to abuse or permanent exposure to the elements.

B. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit dampproofing to be performed according to manufacturers' written instructions.

C. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has cured.

D. Do not apply dampproofing when air or surface temperatures are below 50 degrees Fahrenheit (10 degrees Celsius).

E. Do not apply to frozen concrete.

F. Do not apply when rain is forecasted within 24 hours.

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1.11 WARRANTY

A. Provide a minimum one (1) year guarantee for the performance and installation of all damp-proofing materials and application.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer(s) and basis of design for products shall be as indicated however products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
   1. W. R. MEADOWS, INC., PO Box 338, Hampshire, Illinois 60140-0338. (800) 342-5976. (847) 683-4500. Fax (847) 683-4544. Website: www.wrmeadows.com.

B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product.
   1. Karnak Corp.
   2. Lambert Corp.
   3. BASF

C. Source Limitations: Furnish products produced by single manufacturer and obtained from single supplier.

2.2 DAMPPROOFING MATERIAL

A. Basis of Design Product: "SEALMASTIC TYPE II"
   1. Type II – Brush-on or spray-grade dampproofing coating.
   2. ASTM D1227 Type II, Class I.

B. Fibered Brush and Spray Coats: Semi-mastic, fiber-reinforced, asphalt-emulsion damp-proofing for brush or spray application.

C. Material must be asbestos-free.

2.3 ACCESSORIES

A. Reinforcement Fabric:
   1. Basis of Design Product: "REINFORCING FABRIC HCR" spun-bonded polyester hot/cold reinforcing fabric.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive membrane. Notify the architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

3.2 SURFACE PREPARATION

A. Protect adjacent surfaces not designated to receive dampproofing.

B. Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's instructions.

C. Do not apply dampproofing to surfaces unacceptable to the manufacturer.

D. Concrete surfaces must be clean, smooth, dry and free of standing water.

E. Patch all holes and voids and smooth out any surface misalignments.

3.3 SINGLE-PLY APPLICATION

A. Contractor to coordinate all trades to allow for timely inclusion in the work all items or curing periods necessary for a complete installation.

B. Apply Type I dampproofing emulsion at a rate of 70 to 100 sq feet (0.10764 sq cm) per gallon (1.7 to 2.5 liters per square meter). Alternatively, apply Type II and Type III dampproofing emulsion at a rate of 40 to 50 sq feet (0.05382 sq cm) per gallon (1.0 to 1.2 square meters per liter).

3.4 CLEANING AND PROTECTION

A. During application, immediately clean dampproofing from adjacent surfaces or other areas not specified to receive materials.

B. Maintain work area clean and free of excess waste, empty containers, faulty materials, etc. Immediately remove defective materials from job site.

C. Repair or replace any surface damaged by improper application, over-spray, or other condition to first class originally specified condition and at no additional cost to the Owner.

D. Backfill within 24 to 48 hours after application, using care to avoid damaging the dampproofing.

E. Provide final cleaning of area and treated surfaces before acceptance.

F. Remove all materials not applied and leave area clean and ready for next trade or Owner's use.

END OF SECTION

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SECTION 07 17 00 - BENTONITE WATERPROOFING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Waterproofing at elevator and sump pits.
   2. Waterproofing at foundations.
   3. Waterproofing at walls between high/low floor transitions.

1.3 REFERENCE STANDARDS

A. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds; 1998 (Reapproved 2025).

B. ASTM D5084 - Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter; 2016a.

C. ASTM C836 – Standard Specification for High Solids Content, Cold Liquid Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course.

D. ASTM D1970 – Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

E. ASTM D4632 – Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

F. ASTM D4833 – Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products.

G. ASTM D5385 – Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes.

H. ASTM E96 – Standard Test Methods for Water Vapor Transmission of Materials.

I. ASTM E154 – Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements, for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 – Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 – Product Requirements for substitution procedures.

C. Product Data: For each type of product indicated. Include product specifications and manufacturer's written installation instructions.

D. Shop Drawings: Show installation details for interface with other work.

E. Samples: For each of the following products, in sizes indicated:
   1. Waterproofing: 6 inches (152.4 mm) square.
   2. Drainage Panels: 6 inches (152.4 mm) square.

F. Material Certificates: For each type of bentonite waterproofing product from manufacturer.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for bentonite waterproofing.

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H. Field quality-control reports.

I. Warranty: Sample of special warranty.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain bentonite waterproofing system from single source from single manufacturer. Obtain accessory products used with bentonite waterproofing from sources acceptable to bentonite waterproofing manufacturer.

B. Pre-installation Conference: Conduct conference at Project site.

1.7 PREINSTALLATION CONFERENCE

A. The Contractor shall conduct a pre-installation meeting at the project site a minimum of 30 days prior to any work being installed as indicated in this section and other related sections that require coordination with this section.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original unopened and undamaged containers.

B. Store materials in a dry, well-ventilated space.

C. Remove and replace bentonite materials that have been prematurely exposed to moisture.

1.9 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit bentonite waterproofing to be installed according to manufacturers' written instructions and warranty requirements.
   1. Do not apply bentonite waterproofing materials in areas with standing water.
   2. Placing bentonite clay products in panel or composite form on damp surfaces is allowed if approved in writing by manufacturer.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of bentonite waterproofing system that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Ten (10) years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Manufacturer and basis of design shall be the following. However, products of other manufacturers will be considered for acceptance, provided they equal or exceed the material requirements and functional qualities of the specified product, and acceptance is provided by the Architect in writing prior to bidding.
   1. Colloid Environmental Technologies Company (CETCO).

B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
   1. Carlisle Coatings & Waterproofing.
   2. Tremco, Inc.

2.2 COMPOSITE WATERPROOFING MEMBRANE

A. ULTRASEAL AB – APC WATERPROOFING MEMBRANE
   1. ULTRASEAL AB MEMBRANE: 0.09 inch (2.3 mm) thick composite membrane comprised of a polyethylene liner and an advanced Active Polymer Core (APC) layer integrally bonded to an aggressive pressure sensitive adhesive that locks the membrane to concrete. ULTRASEAL AB applications include under slab, property line retention walls, backfilled walls, and earth covered structures. Roll size: 1.31 yard (1.2 meter) x 8.31 yard (7.6 meter)

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2. ULTRASEAL AB performance properties:

PROPERTY	TEST METHOD	TYPICAL VALUE
Hydrostatic Pressure Resistance	ASTM D 5385 mod.	70 m 231 feet (7040.88 cm)
Permeability	ASTM D5084	<1 x 10-11 cm/sec.
Peel Adhesion to Concrete	ASTM D903 mod.	2.63 kN/m (15 lbs./in)
Grab Tensile Strength	ASTM D 4632	667 N (150 lbs)
Puncture Resistance	ASTM D 4833	311 N (70 lbs)
Elongation	ASTM D 4632	50%
Crack Bridging	ASTM C 836	Passed
Resistance to Decay	ASTM E 154	Passed
Permeance	ASTM E 96 B	0.03 Perms

2.3 ACCESSORY WATERPROOFING PRODUCTS

A. All accessory waterproofing materials shall be provided by the waterproofing manufacturer or shall have manufacturer's written approval for substitution.
   1. BENTOSEAL®: Trowel grade detailing mastic
   2. HYDROBAR TUBES®: 1.97 inch (50 mm) diameter x 1.97 feet (60 cm) long, water soluble tube container filled with active granular material
   3. WATERSTOPPAGE®: 22.7 kg (50 lbs.) bag of active granular material.
   4. SEAMTAPE: 2.95 inch (75 mm) wide rubber-based sealant tape.
   5. Termination Bar: Min. 0.12 inch (3 mm) thick by 0.98 inch (25 mm) wide stainless steel or aluminum termination bar with pre-punched holes punched 5.91 inch (150 mm) on center for fastening.
   6. CORETEX: A low permeable geotextile waterproofing material that utilizes Active Polymer Core (APC) technology.
   7. CETSEAL™: Single-component polyether general sealant and adhesive
   8. ENVIROSHEET: Self-adhering flashing membrane used for grade and thru-wall detailing.

2.4 BASE AND SHEET DRAINAGE COMPOSITE

A. AQUADRAIN® drainage composite by CETCO shall be used where specified to promote positive drainage. Use base drain accessory connectors and outlets as required.
   a. AQUADRAIN 15XP – 1.2m x 15.8m (4-ft x 52-ft) roll of a three-dimensional polypropylene drainage core with a nonwoven geotextile adhered to one side to allow water passage while restricting soil particles. Composite includes a thin polyethylene sheet on the back of the drainage core.
      1) Compressive Strength, 104 psi (718 kPa); B. Water Flow Rate, 251 l/m/m (20gpm/ft);
      2) Thickness, 0.43 inch (11 mm)
   b. AQUADRAIN 100BD Base Drain – 0.98 inch (25 mm) thick x 11.81 inch (300 mm) high base drain composite designed to collect water from sheet composite drainage and then discharge the water to proper sump system or gravity to daylight.
      1) Compressive Strength, 66 psi (457 kPa); B. Water Flow rate, 1,197 l/m/m (97gpm/ft);
      2) Thickness, 0.98 inch (25 mm)

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate preparations affecting performance of bentonite waterproofing.

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B. Verify that substrate is complete and substrate conditions are acceptable for the waterproofing installation.

C. Mechanical or other penetrations: Mechanical, structural, or architectural materials will pass through the plane of he waterproofing membrane shall be properly installed and secured in their final position prior to installation of the waterproof system.

D. Proceed with installation only after unsatisfactory conditions have been corrected and are acceptable for compliance with manufacturer's warranty requirements.

3.2 PREPARATION

A. Coordinate work in the vicinity of waterproofing to ensure proper conditions for installing the waterproofing system and to prevent damage to waterproofing after installation.

B. Working Mud Slab: Working concrete mud slabs should have a float finish to provide a planar surface; without sharp angular depressions, voids or raised features.

C. Compacted Soil or Gravel Sub-Grade: Sub-grade shall be compacted to a minimum Modified Proctor compaction of 85% or greater as specified by civil/geotechnical engineer. The finished sub-grade surface shall be well-leveled, uniform, free of debris and standing water or ice. Aggregate sub-grades shall consist of 0.75 inch (19 mm) stone or smaller and rolled flat, free from any protruding sharp edges. If substrate consists of large aggregate, place a high-strength geotextile layer over the aggregate and then provide several inches of compacted soil or sand for uniform support and containment of waterproofing sheets.

D. Formed Concrete Surfaces: Remove fins and projections. Fill voids, rock pockets, form-tie holes, and other defects with bentonite mastic or cement grout patching material according to manufacturer's written instructions.

1. Concrete to be waterproofed shall be properly placed and consolidated. Reinforced structural slabs should be a minimum of 5.91 inch (150 mm) thick when placed on a working mud slab. Reinforced concrete slab(s) on compacted grade shall be a minimum of 3.94 inch (100 mm) thick. Install ULTRASEAL AB under all footings, elevator pits and grade beams. Cast-in-place concrete to receive waterproofing shall be of sound structural grade with a smooth finish, free of debris, oil, grease, laitance, dirt, dust, or other foreign matter which will impair the performance of the waterproofing and drainage system and which do not comply with manufacturer's warranty requirements.
2. Remove dirt, debris, oil, grease, cement laitance, or other foreign matter which will impair or negatively affect the performance of the waterproofing and drainage system.
3. Protect adjacent work areas and finished surfaces from damage or contamination from waterproofing products during installation operations.
4. Form fins, ridges, ponding ridges and other protrusions should be level and smooth with concrete surface.
5. Honeycombing, aggregate pockets, tie-rod holes and other voids shall be completely filled with non-shrink cementitious grout and level with monolithic concrete surface.
6. Related work to be completed under Division 3. Waterstop-RX shall be installed in all applicable vertical and horizontal concrete construction cold pour joints and around applicable penetrations, structural members, and tie-rod form holes that extend through the wall. Refer to Waterstop-RX Product Manual for further installation procedures and guidelines.

E. Excavation Support and Protection System: If water is seeping, use plastic protection sheets or other suitable means to prevent wetting the bentonite waterproofing. Fill minor gaps and spaces 1/8 inch (3.18 mm) wide or wider with wood, metal, concrete, or other appropriate filling material. Cover or fill large voids and crevices with cement mortar according to manufacturer's written instructions.

3.3 INSTALLATION, GENERAL

A. Install waterproofing and accessories according to manufacturer's written instructions.

3.4 SLAB / BACKFILLED WALL FOOTING EDGE TRANSITION COURSE

A. Inside the slab/footing form edge, secure ULTRASEAL AB sheet horizontally oriented (poly side down; APC facing installer) to the top inside edge of the exterior slab/footing form with the sheet conforming to the interior form surfaces and then extending out onto the horizontal slab substrate a minimum 11.81 inch (300 mm). Overlap edges of adjacent ULTRASEAL AB sheets a minimum 3.94 inch (100 mm) and secure to prevent sheet movement during construction or concrete placement.

B. Install ULTRASEAL AB membrane (poly side down; APC side up) extending to interior edge of footing/slab edge, fully overlapping the 11.81 inch (300 mm) horizontal tail of the ULTRASEAL AB slab edge sheet installed in Section 3.04B. Overlap edges of adjacent sheets a minimum 3.94 inch (100 mm) and secure to prevent sheet movement during construction or concrete placement.

C. Place ULTRASEAL AB directly on properly prepared substrate (poly side down; APC side up facing installer) with adjoining edges overlapped a minimum of 3.94 inch (100 mm). Stagger sheet end seams a minimum of 11.81 inch (300 mm). Mechanically fasten or staple ULTRASEAL AB 11.81 inch (300 mm) on center to prevent movement from construction operations or concrete placement. When the slab is poured in sections, extend ULTRASEAL AB a minimum 11.81 inch (300 mm) beyond the slab edge to enable proper overlapping.

D. Install waterproofing system at all grade beams, pile caps, and other detail areas in accordance with manufacturer’s detail for specific project condition(s).

E. Slab Penetrations: For all pipe, rebar, structural or other penetrations install waterproofing system in accordance with manufacturer’s standard detail for specific project condition(s).

F. Inspect finished ULTRASEAL AB installation and repair any damaged material prior to concrete slab placement.

G. Related work to be completed under Division 3. Waterstop-RX shall be installed in all slab joints, around applicable slab penetrations and structural members. Refer to Waterstop-RX Product Manual for further installation procedures and guidelines.

3.5 BACKFILLED CAST-IN-PLACE CONCRETE WALLS

A. Place HYDROBAR TUBES along the wall/footing intersection with ends “butted” tightly together to form a continuous installation.

B. Trowel 0.75 inch (19 mm) thick, continuous BENTOSEAL fillet at all inside wall corner transitions. Trowel BENTOSEAL form-tie pockets/patches and any slightly irregular concrete surface honeycomb areas.

C. Starting at the base of the wall, install ULTRASEAL AB sheet horizontally (APC side against the wall; white poly side facing installer) covering the HYDROBAR TUBES and extending onto the footing a minimum of 5.91 inch (150 mm). For hydrostatic conditions, cover the entire footing and overlap waterproofing membrane from underslab work a minimum of 5.91 inch (150 mm). Attach ULTRASEAL AB using washer-headed mechanical fasteners maximum 23.62 inch (600 mm) on center and tape overlap with CETCO SEAMTAPE. Overlap all adjacent sheet edges a minimum 1.97 inch (50 mm). Stagger all vertical overlap seams a minimum of 11.81 inch (300 mm). Tape all membrane overlap seams with CETCO SEAMTAPE.

D. After the bottom horizontal course, ULTRASEAL AB sheets can be installed either vertically or horizontally oriented. Continue installation up wall to finished grade elevation detail, staggering all sheet roll ends of adjacent courses a minimum 11.81 inch (300 mm). Do not allow horizontal ULTRASEAL AB overlap joints to run at same elevation as the concrete pour lift joints. Overlap all adjacent sheet edges a minimum 1.97 inch (50 mm) and secure with washer-head fastener maximum 23.62 inch (600 mm) on center. Tape all membrane overlap seams with CETCO SEAMTAPE.

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E. Penetrations: For all pipe, rebar, structural and other penetrations install waterproofing system in accordance with manufacturer's detail for specific project condition(s).

F. Terminate ULTRASEAL AB membrane 11.81 inch (300 mm) below finished grade elevation secured with washer-head fasteners maximum 11.81 inch (300 mm) on center to exterior surface of concrete wall. Per manufacturer's detail for specific project condition(s), install ENVIROSHEET grade flashing to primed concrete substrate with bottom edge overlapping top edge of ULTRASEAL AB membrane minimum 5.91 inch (150 mm). Overlap all roll ends a minimum 3.94 inch (100 mm) to form a continuous flashing. Height of flashing shall be per project details and specifications. Install a rigid termination bar along the top edge of ENVIROSHEET; fastened maximum 11.81 inch (300 mm) on center. Complete grade termination detail with tooled bead of CETSEAL along the top edge, at all penetrations through the flashing, and all exposed overlap seams.

G. Inspect finished ULTRASEAL AB installation and repair any damaged material prior to backfill placement. Assure that ULTRASEAL AB is not displaced during backfill placement or soil compaction.

3.6 PREFABRICATED DRAINAGE COMPOSITE INSTALLATION

A. At the base of the wall, place AQUADRAIN 100BD base-drain horizontally oriented with the open core side up and the 1.97 inch (50 mm) flap of fabric side tight against the wall over the previously installed ULTRASEAL AB waterproofing using wash-head mechanical fasteners or general construction adhesive. The 1.97 inch (50 mm) fabric flap along the top edge of 100BD should be tightly secured against the wall. Use 100BD accessory fittings, as required, to form a continuous installation. Install 100BD discharge outlet fittings to connect to discharge pipes as required for the project.

B. Install the bottom course of AQUADRAIN 15XP sheet drainage (plastic core side against the wall) with the 15XP bottom core edge in contact with open top core edge of 100BD. Secure sheet drain to wall with washer-head fasteners. Secure extra fabric flap of 15XP extending down the top front edge of 100BD to prevent the passage of soil into the core at the connection.

C. Install subsequent courses of AQUADRAIN 15XP sheet drainage to within 11.81 inch (300 mm) of finished grade or as shown on the project drawings. Tightly abut adjoining sheet drain core edges together and secure the extra fabric flaps over the front of adjacent roll edges to prevent soil from entering the sheet drain. Secure sheet drain to wall with washer-head fasteners. Where drainage sheet panels are installed overlapped, bottom edge of higher course shall be installed to the outside of the lower course to shed water like a roof shingle.

D. Around penetrations and tie-back heads, cut sheet drainage composite to fit and wrap extra filter fabric around open core edge to prevent soil from entering core.

E. At the top of the sheet drain installation, wrap the filter fabric flap behind the exposed top core edge to prevent intrusion of soil into the core and secure sheet drain to wall with termination bar fastened 11.81 inch (300 mm) on center.

3.7 BACKFILL EXCAVATED CAST-IN-PLACE CONCRETE WALLS

A. Backfill shall be placed and compacted to minimum 85% Modified Proctor density promptly after waterproofing has been installed. Closely coordinate with contractor responsible for Backfill work by informing them each time a waterproofed area is ready for backfill. Backfill shall consist of compactable soil or angular aggregate free of debris, sharp objects, and stones larger than 0.75 inch (19 mm). Care should be used during backfill operation to avoid damage to the waterproofing system. If damage occurs, cease backfilling and report damage. Damaged waterproofing must be repaired per manufacturer's guidelines.

3.8 CLEAN UP

A. In areas where adjacent finished surfaces are soiled by work of this Section, consult manufacturer of surfaces for cleaning advice and conform to their recommendations and

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instructions. Remove all tools, equipment and remaining product on-site. Dispose of section work debris and damaged product following all applicable regulations.

3.9 FIELD QUALITY CONTROL

A. Inspection: Arrange for manufacturer's representative to inspect completed waterproofing installation before covering with other construction and provide written report that installation complies with manufacturer's written instructions.

B. Remove and replace applications of bentonite waterproofing where inspection indicates that it does not comply with specified requirements.

END OF SECTION

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SECTION 07 18 00 - TRAFFIC COATINGS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to traffic coatings and pavement markings for the following applications:
   1. Pedestrian traffic.

1.3 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.

B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

C. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2025.

D. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating; 2023.

E. ASTM D4259 - Standard Practice for Preparation of Concrete by Abrasion Prior to Coating Application; 2024.

F. ASTM D4263 - Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method; 1983 (Reapproved 2018).

G. ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces; 2011 (Reapproved 2019).

H. UL 790 - Standard for Standard Test Methods for Fire Tests of Roof Coverings; Current Edition, Including All Revisions.

I. ASTM C 957 – Standard Specification for High-Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane with Integral Wearing Surface.

J. ASTM C 1127 – Standard Guide for Use of High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane with an Integral Wearing Surface.

K. U. S. Environmental Protection Agency (EPA): www.epa.gov.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements, for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 - Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 - Product Requirements for substitution procedures.

C. Product Data: Include installation instructions and details, material descriptions, dry or wet film thickness requirements, and finish.

D. Shop Drawings: Include details for treating substrate joints and cracks, flashings, deck penetrations, and other termination conditions that are not included in manufacturer's product data.
   1. Include plans showing layout of pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

E. Samples: For each type of exposed finish, prepared on rigid backing. Provide stepped Samples on backing to illustrate buildup of traffic coatings.

F. Qualification Data: For Installer.

G. Sample Warranty: For manufacturer's warranty.

1.6 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Provide products from a firm that makes the indicated products as a regular production item and with not less than ten (10) years experience.

B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation of specified materials and assemblies with not less than three (3) years experience.

1.7 PERFORMANCE REQUIREMENTS

A. Material Compatibility: Provide primers; base coat, and topcoat; and accessory materials that are compatible with one another and with substrate under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

1.8 MOCKUPS

A. Mockups: Apply mockups to set quality standards for materials and execution.

B. Architect will select one representative surface for each traffic coating and each substrate to receive traffic coatings. Apply each coating to at least 200 sq. ft. of each substrate to demonstrate surface preparation, joint and crack treatment, thickness, texture, color, and standard of workmanship.

C. Remove and reapply mockups until they are approved by Architect.

D. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 PRE-INSTALLATION MEETING

A. The Contractor shall conduct a pre-installation meeting at the project site a minimum of 30 days prior to any work being installed as indicated in this section and other related sections that require coordination with this section.

B. Before installing traffic coatings, meet with representatives of authorities having jurisdiction, manufacturer's technical representative, Owner, Architect, consultants, independent testing agency, and other concerned entities. Review requirements for traffic coatings. Notify participants at least seven days before conference.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Apply traffic coatings within the range of ambient and substrate temperatures recommended in writing by manufacturer. Do not apply traffic coatings to damp or wet substrates, when temperatures are below 40 deg F, when relative humidity exceeds 85 percent, or when temperatures are less than 5 deg F above dew point.

1. Do not apply traffic coatings in snow, rain, fog, or mist, or when such weather conditions are imminent during the application and curing period. Apply only when frost-free conditions occur throughout the depth of substrate.

B. Do not install traffic coating until items that penetrate membrane have been installed.

1.11 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace traffic coating that fails in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Adhesive or cohesive failures.
   b. Abrasion or tearing failures.

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c. Surface crazing or spalling.
d. Intrusion of water, oils, gasoline, grease, salt, deicer chemicals, or acids into deck substrate.

2. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
1. Tremco, Inc.

B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product.
1. BASF
2. Pecora Corporation
3. TRAFFIC COATING

C. Basis of Design: “Tremco Vulkem 350NF / 351NF”

D. Traffic Coatings: Low-odor, low-VOC, exterior exposure, pedestrian traffic-bearing, seamless, with high-solids-content, and cold liquid-applied, elastomeric, waterproofing membrane system meeting ASTM C 957, and SWRI validated.

E. VOC Content: Not greater than 60 g/L for base coat and 100 g/L for topcoat.

F. Primer: Liquid primer recommended for substrate and conditions by traffic-coating manufacturer.

G. Base Coat: Aromatic Polyurethane.

H. Topcoat: Aliphatic Polyurethane with UV inhibitors.

I. Topcoat Aggregate: Manufacturer's standard aggregate for each use indicated of particle sizes, shape, and minimum hardness recommended in writing by traffic-coating manufacturer.

J. Color: As selected by Architect from Manufacturer's full range.

2.2 ACCESSORY MATERIALS

A. General: Accessory materials as described in manufacturer's written installation instructions, recommended to produce complete traffic coating system meeting performance requirements, and compatible with traffic coating material and adjacent materials.

B. Single-Component, Non-Sagging Polyurethane Joint Sealant: ASTM C920, Type NS, Class 50.
1. Basis of Design Product: Dymonic 100

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, surface smoothness, and other conditions affecting performance of traffic-coating work.

B. Verify that substrates are visibly dry and free of moisture.
1. Test for moisture according to ASTM D4263.

C. Proceed with installation only after unsatisfactory conditions have been corrected.
1. Begin coating application only after substrate construction and penetrating work have been completed.

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2. Begin coating application only after minimum concrete-curing and -drying period recommended in writing by traffic-coating manufacturer has passed and after substrates are dry.
3. Application of coating indicates acceptance of surfaces and conditions.

D. Surface Condition: Before applying traffic coating materials, examine substrate and conditions to ensure substrates are fully cured and free from high spots, depressions, loose and foreign particles and other deterrents to adhesion, and conditions comply with manufacturer's written recommendations.
1. Verify concrete surfaces are visibly dry, have cured for time period recommended by traffic coating manufacturer, and are free from release agents, curing agents, laitance, and other contaminates.
2. Test surfaces following cleaning and abrasion specified below.
a. Test for capillary moisture by method recommended in writing by traffic-coating manufacturer.
b. Test for traffic coating adhesion per manufacturer's recommended method.
c. Notify Architect in writing of unsatisfactory conditions.

E. Proceed with installation once unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean, prepare, and treat substrates in accordance with ASTM C 1127 and traffic coating manufacturer's written instructions.
1. Remove contaminants, curing compounds, and film-forming coatings from substrates.
2. Remove projections and excess materials and fill voids with manufacturer's recommended substrate patching material.
3. Prepare surfaces to a uniform profile in accordance with ASTM D4259 and meeting ICRI Surface Profile CSP 2 - 4. Do not acid etch.
4. Clean prepared surfaces in accordance with ASTM D4258.

B. Protect adjacent finished surfaces by masking. Mask termination point on vertical surfaces. Protect weep holes and drains.

3.3 TERMINATIONS AND PENETRATIONS

A. Detail Preparation: Prepare vertical and horizontal surfaces at horizontal to vertical transitions, terminations, joints, and penetrations through traffic coatings in accordance with ASTM C 1127 and manufacturer's written instructions, using accessory materials specified.
1. At terminations of traffic coating exposed to traffic, rout 1/4 by 1/4 inch (6.35 mm) keyway in concrete.
2. Prepare non-moving shrinkage cracks, large cracks, construction joints, expansion joints, projections and protrusions, penetrations, drains, and changes in plane in accordance with manufacturer's written instructions and details.
3. Prepare joints and cracks in substrate in accordance with ASTM C 1127 and ASTM D4258 and manufacturer's written instructions.

B. Joint Sealant Installation: Comply with ASTM C1193 and manufacturer's written instructions. Allow joint sealants to cure adequately before coating with traffic coating.
1. Provide joint sealant cants with backer rods at penetrations and at horizontal-to-vertical intersections. Tool sealant material to form 45-degree angle transition.
2. Rout and fill cracks with joint sealant and tool flush with surface.
3. Feather edges of joint sealant applications.
4. Allow joint sealant to cure. Apply detail coat of base coat over unfilled and filled cracks and joints, and feather terminating edges.
5. Fill expansion joints with backer rod and joint sealant. Do not apply traffic coating over expansion joints.

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3.4 APPLICATION

A. Primer: Prime metal surfaces, porous surfaces (when required), and preceding coats left uncoated for more than 24 hours or that have lost surface tack, with manufacturer's recommended primer. Allow to cure before proceeding.

B. Apply traffic coating according to ASTM C 1127 and manufacturer's written instructions. Use roller-applied or self-leveling formulations as recommended by manufacturer for project conditions.
   1. Verify that wet film thickness of each coat complies with requirements every 100 sq. ft.

C. Apply number of coats of specified compositions for pedestrian traffic coating at locations indicated on Drawings.
   1. Base Coat: Single application of not less than 40 mil (1.016 mm).
   2. Top Coat: Single application at not less than 15 mil (0.381 mm).
   3. Aggregate: Uniformly broadcast aggregate on coats specified to receive aggregate. Embed aggregate according to manufacturer's written instructions.

D. Apply traffic coatings to prepared wall terminations and vertical surfaces to height indicated; omit aggregate on vertical surfaces.

E. Cure traffic coatings. Prevent contamination and damage during application and curing stages.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to inspect substrate conditions, surface preparation, traffic coating application, protection, and drainage components, and to furnish reports to Architect

B. Coordination of Testing: Cooperate with testing agency. Allow access to work areas and staging. Notify testing agency in writing of schedule for Work of this Section to allow sufficient time for testing and inspection.
   1. Do not cover Work until testing and inspection is completed and accepted.

C. Reporting: Forward written inspection reports to the Architect within 3 working days of the inspection and test being performed.

D. Correction: Correct deficient applications not passing tests and inspections, make necessary repairs, and retest as required to demonstrate compliance with requirements.

3.6 CLEANING AND PROTECTING

A. Clean spills, stains, and overspray resulting application utilizing cleaning agents recommended by manufacturers of affected construction. Remove masking materials.

B. Protect traffic coating from damage from subsequent work. Protect traffic coating materials from exposure to UV light for period in excess of that acceptable to traffic coating manufacturer; replace overexposed materials and retest.

END OF SECTION

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SECTION 07 21 00 - THERMAL INSULATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, materials, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Mineral wool batt.
   2. Extruded polystyrene foam-plastic (XPS).
   3. Loose fill mineral wool.

1.3 REFERENCE STANDARDS

A. ASTM C209 - Standard Test Methods for Cellulosic Fiber Insulating Board; 2020.

B. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

C. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.

D. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2025.

E. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2024.

F. ASTM C726 - Standard Specification for Mineral Wool Roof Insulation Board; 2017.

G. ASTM C764 - Standard Specification for Mineral Fiber Loose-Fill Thermal Insulation; 2025.

H. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2023a.

I. ASTM D1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics; 2016 (Reapproved 2023).

J. ASTM D5116 - Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products; 2017.

K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

L. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2026.

M. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C; 2024c.

N. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

O. ASTM C236 – Standard Test Method for Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box.

P. ASTM E96 – Test Method for Water Vapor Transmission of Material.

Q. NFPA 255 – Test of Surface Burning Characteristics of Building Materials.

R. ASHRAE Handbook.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements, for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 – Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 – Product Requirements for substitution procedures.

C. Product Data: For each type of product indicated including performance.

D. Product Test Reports: For each product, for tests performed by a qualified testing agency.

E. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention; cautionary procedures required during application.

F. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.6 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Insulation Protection: Do not expose to sunlight except to necessary extent for period of installation and concealment. Protect against ignition at all times and do not deliver materials to project site before installation time.

1.8 WARRANTY

A. Provide written warranty from the manufacturer that the actual thermal resistance of the extruded polystyrene insulation will not vary by more than 10% from its published thermal resistance.

B. Warranty period is 15-years from the date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Manufacturer(s) and basis of design for products shall be one of the following. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
   1. Dow Chemical Co.

B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
   1. CertainTeed Corporation
   2. Johns Manville
   3. Owens Corning
   4. Knauf Insulation
   5. Atlas Roofing Corp.
   6.
   7. Dow Chemical Co.
   8. Atlas Roofing Corp.

2.2 MINERAL WOOL BATT

A. Unfaced Mineral Wool Batt: ASTM C665, Type I, Class 1 with maximum flame-spread of 25 and smoke-developed indexes of 50, respectively, per ASTM E84.
   1. Loose fill density: 4 – 6 lbs.cu. ft.
   2. Thickness: Total thickness shall be 3 1/2" and as indicated on drawings.

2.3 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD (XPS)

A. Basis of Design Product: “Styrofoam Square Edge.”

B. Extruded Polystyrene Board: Unfaced, ASTM C578, Type IV with maximum flame-spread of 15 and smoke-developed indexes of 165, respectively, per ASTM E84.
   1. R-Value: As indicated on drawings.
   2. Thickness: As indicated on drawings.

C. Provide in gypsum wall board exterior wall cavities and as indicated on drawings.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to rain at any time.

C. Extend insulation to envelop entire building to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF BATT INSULATION IN FRAMED CONSTRUCTION

A. Batt Insulation: Install in cavities formed by framing members and where indicated according to the following requirements:
   1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
   2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.

B. Miscellaneous Voids: Install loose fill insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation.

3.4 INSTALLATION OF INSULATION ON INTERIOR FACE OF EXTERIOR WALL

A. Board Insulation: Install spindle-type anchors spaced as recommended by manufacturer. Fit insulation tight to obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.

B. Do not apply tape to inside face of rigid foil backed insulation.

3.5 DRAFT STOPPING

A. Provide draft stopping in any concealed space of the extruded insulation at the ceiling line, at locations where interior wall(s) intersect or abut the exterior wall, at no more than 20' intervals in large rooms with walls over 10', and as required by FBC.

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1. Draft stopping shall be solid minimum 22-gauge metal strip.
2. Anchor draft stopping independent of the extruded insulation.

3.6 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

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SECTION 07 27 15 - SELF-ADHERING SHEET AIR BARRIER

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Self-adhering, modified bituminous sheet air barrier in wall cavities.
   2. Drainage mat behind cement plaster (Building # 6).

1.3 REFERENCE STANDARDS

A. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).

B. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016 (Reapproved 2021).

C. ASTM D570 - Standard Test Method for Water Absorption of Plastics; 2022.

D. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds; 1998 (Reapproved 2025).

E. ASTM D1004 - Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting; 2021.

F. ASTM D1876 - Standard Test Method for Peel Resistance of Adhesives (T-Peel Test); 2008 (Reapproved 2023).

G. ASTM D4263 - Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method; 1983 (Reapproved 2018).

H. ASTM D4541 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers; 2022.

I. ASTM D5034 - Standard Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test); 2021 (Reapproved 2025).

J. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2023).

K. ASTM E1186 - Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems; 2022.

L. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.

M. ASTM E2357 - Standard Test Method for Determining Air Leakage Rate of Air Barrier Assemblies; 2024.

N. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components; 2023.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 – Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 – Product Requirements for substitution procedures.

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C. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate and technical data; and tested physical and performance properties of air barrier.

D. Shop Drawings: Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
   1. Include details of interfaces with other materials that form part of air barrier.
   2. Include details of mockups.

E. Samples: Submit representative samples of the following for approval:
   1. Self-Adhered Air Barrier Membrane.
   2. Self-Adhered Transition Membrane.
   3. Self-Adhered Through Wall Flashing.
   4. Drainage Mat (for cement plaster repairs where needed for Building # 6).

F. Product Certificates: For air barriers, certifying compatibility of air barrier and accessory materials with project materials that connect to or that come in contact with the barrier; signed by product manufacturer.

G. Qualification Data: For Applicator.

H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for air barriers, submit certified test report showing compliance with requirements specified for ASTM E2178.

I. Warranty: Submit a sample warranty identifying the terms and conditions

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: From barrier manufacturer, certifying compatibility of barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for air barriers, submit certified test report showing compliance with requirements specified.

D. Field quality-control reports.

1.7 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Provide products from a firm that makes the indicated products as a regular production item and has the capability of providing quantity of units so as not to delay the progress of work at Project site. with not less than ten (10) years experience.

B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation of specified materials and assemblies with not less than five (5) years experience.

C. Manufacturer’s Requirements: Manufacturer shall provide trained company personnel to attend necessary project meetings, perform periodic inspections, and conduct a final inspection upon completion of the Work.

1.8 PRE-INSTALLATION MEETING

A. The Contractor shall conduct a pre-installation meeting at the project site a minimum of 30 days prior to any work being installed as indicated in this section and other related sections that require coordination with this section.

B. Review barrier requirements and installation, special details, mockups, air-leakage and bond testing, air and moisture barrier protection, and work scheduling that covers barriers.

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1.9 DELIVERY, STORAGE AND HANDLING

A. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer's instructions, recommendations, and material safety data sheets. Protect from damage from sunlight, weather, excessive temperatures, and construction operations. Remove damaged material from the site and dispose of in accordance with applicable regulations.

B. Do not double-stack pallets of fluid applied components on the job site. Provide cover on top and all sides, allowing for adequate ventilation.

C. Protect fluid-applied membrane components from freezing and extreme heat.

D. Sequence deliveries to avoid delays but minimize on-site storage.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Apply barrier within the range of ambient and substrate temperatures recommended by barrier manufacturer.
   1. Protect substrates from environmental conditions that affect barrier performance.
   2. Do not apply barrier to a damp or wet substrate or during snow, rain, fog, or mist.

1.11 WARRANTY

A. Submit manufacturer's warranty that air and moisture barrier and accessories are free of defects at time of delivery and are manufactured to meet manufacturer's published physical properties and material specifications.

B. Warranty Period: Five (5) years from date of Substantial Completion.

1.12 PERFORMANCE REQUIREMENTS

A. General: Barrier shall be capable of performing as a continuous vapor-permeable barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer and basis of design shall be the following. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product and acceptance is provided by the Architect in writing prior to bidding.
   1. GCP Applied Technologies

B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product.
   1. Carlisle Coatings & Waterproofing, Inc.
   2. Tremco Incorporated, an RPM company

C. Substitutions: See Section 01 60 00.0 - Product Requirements for substitution procedures.

2.2 SELF-ADHERED AIR AND MOISTURE BARRIER MEMBRANE

A. Basis of Design: "Perm-A-Barrier VPS 30"

B. A self-adhered membrane consisting of a breathable carrier film with a specially designed adhesive, which permits the transfusion of water vapor and provides superior protection against the damaging effects of air and water ingress on building structures, Product shall have the following minimum physical properties:
   1. Air Permeance, ASTM E2178: Not to exceed 0.004 cfm/sq. ft. under a pressure differential of 0.3 inch (7.62 mm). water. 1.57 psf.

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2. Assembly Air Permeance, ASTM E2357: Not to exceed 0.04 cfm/sq.ft. under a pressure differential of 0.3 inch (7.62 mm). water 1.57 psf.
3. Water Vapor Permeance, ASTM E96, Method B Greater than 10 perms
4. Water Resistance, AATCC-127: No less than 5 hrs at 1.8 feet (55 cm)/21 inch
5. Pull Adhesion, ASTM D4541: min. 16 psi (110.32 kPa)
6. Peel Adhesion, ASTM D903 (modified), min. 1.5pli, per AC 38
7. UV Exposure Limit: Not more than 150 days
8. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly
9. Assembly Water Penetration, ASTM E331. Pass at. 15 psf.

C. Transition Membrane (Primerless): Perm-A-Barrier® NPS Detail Membrane as manufactured by GCP Applied Technologies, 62 Whittemore Avenue, Cambridge, MA; 0.018 inch (0.46 mm) thick, sheet-applied, vapor impermeable membrane that forms a resilient, monolithic, fully bonded elastomeric membrane when applied to construction surfaces. The HDPE/Aluminum based membrane provides superior protection against the damaging effects of air and liquid water ingress on the building structures. Product shall meet the following requirements:

D. Membrane Air Permeance: ASTM E2178: Not to exceed 0.004 cfm/sq. ft. under a pressure differential of 0.3 inch (7.62 mm). water 1.57 psf.

E. Water Resistance: ASTM E331: Pass at 15 psf.

F. Water Vapor Permeance: ASTM E96, Method A: < 1 perm

G. Water Vapor Permeance: ASTM E96, Method B: < 1 perm

H. Elongation: ASTM D412-Die C: minimum 200%

I. Low temperature flexibility and crack bridging: ASTM C1305: Pass.

J. Nail sealability: ASTM D1970: Pass

K. Transition Membrane: A 36 mil (0.9144 mm) of self-adhesive rubberized asphalt integrally bonded to 4 mil (0.1016 mm) of cross-laminated, high-density polyethylene film to provide a min. 40 mil (1.016 mm) thick membrane. Membrane shall be interleaved with disposable silicone-coated release paper until installed, conforming to the following:
   1. Water Vapor Transmission, ASTM E96, Method B: 0.05 perms max.
   2. Air Permeance at 75Pa 0.3 inch (7.62 mm). water) pressure difference: 0.00012 cfm/ft2 max.
   3. Puncture Resistance, ASTM E154: 40 lbs. min.
   4. Lap Adhesion at -4ºC (25ºF), ASTM D1876: 5.0 lbs./in. of width
   5. Low Temperature Flexibility, ASTM D1970: Unaffected to -45ºF
   6. Tensile Strength, ASTM D412, Die C Modified: min. 400 psi (2757.90 kPa)
   7. Elongation, Ultimate Failure of Rubberized Asphalt, ASTM D412, Die C: min. 200%.

L. Transition Membrane: Manufacturer’s Liquid Flashing; a fluid applied single component STPE elastomeric flashing installed at 25 wet mils, conforming with the following:
   1. Water Vapor Transmission: ASTM E96, Method B: Minimum 10 perms.
   2. Solids content by volume: 100%
   3. Cure Time @ 50% R.H. 70F: 24 hr.
   4. Elongation, ASTM D412: 250%
   5. Tensile Strength, ASTM D412: 200 psi (1378.95 kPa)
   6. Nail Sealability, ASTM D1970: Pass

M. Transition Aluminum Membrane: Manufacturer’s Aluminum Flashing; a 35 mil (0.889 mm) of self-adhesive rubberized asphalt integrally bonded to 5 mil (0.127 mm) of aluminum film to provide a min. 40 mil (1.016 mm) thick membrane. Membrane shall be interleaved with disposable silicone-coated release paper until installed, conforming to the following:
   1. Water Absorption, ASTM D570: Max 0.1% by weight
   2. Puncture Resistance, ASTM E154: 80 lbs min.

3. Lap Adhesion at -4ºC (25ºF), ASTM D1876 Modified: 5.0 lbs./in. of width.
4. Low Temperature Flexibility, ASTM D1970 Modified: Unaffected to -15ºF.
5. Tensile Strength, ASTM D412, Die C Modified: min. 600 Psi
6. Elongation, Ultimate Failure of Rubberized Asphalt: ASTM D412, Die C Modified: min. 200%

N. Flexible Membrane Through-Wall Flashing: Manufacturer's Wall Flashing; a 32 mil (0.8128 mm) of self-adhesive rubberized asphalt integrally bonded to 8 mil (0.2032 mm) of cross-laminated, high-density polyethylene film to provide a min. 40 mil (1.016 mm) thick membrane. Membrane shall be interleaved with disposable silicone-coated release paper until installed, conforming to the following:
   1. Water Vapor Transmission, ASTM E96, Method B: 0.05 perms max.
   2. Water Absorption, ASTM D570: max. 0.1% by weight
   3. Puncture Resistance, ASTM E154: 80 lbs. min.
   4. Tear Resistance
      a. Initiation, ASTM D1004: min. 13.0 lbs. M.D.
      b. Propagation, ASTM D1938: 9.0 lbs. M.D.
   5. Lap Adhesion at 25ºF, ASTM D1876: 5.0 lbs./in. of width
   6. Low Temperature Flexibility, ASTM D1970: Unaffected to -45ºF
   7. Tensile Strength, ASTM D412, Die C Modified: min. 5.5 MPa 800 psi (5515.81 kPa)
   8. Elongation, Ultimate Failure of Rubberized Asphalt, ASTM D412, Die C: min. 200%

O. High Temperature Membrane: Manufacturer's "Ultra" high temperature membrane; a 26 mil (0.6604 mm) of self-adhesive butyl integrally bonded to 4 mil (0.1016 mm) of high-density polyethylene film to provide a min. 30 mil (0.762 mm) thick membrane. Membrane shall be interleaved with disposable silicone-coated release paper until installed, conforming to the following:
   1. Heat Resistance, 300F
   2. Tensile Strength, ASTM D412 (Die C modified): 250 psi (1723.69 kPa)
   3. Elongation, membrane, ASTM D412 (Die C modified): 250%
   4. Adhesion to plywood, ASTM D903: 3.0 lbs/in. width
   5. Low Temperature Flexibility, ASTM D1970: Unaffected to -20ºF

2.3 PRIMERS (AS REQUIRED FOR MOST INSTALLATION APPLICATIONS)

A. Wall Primer for Self-adhered transition membrane and Self-adhered flexible membrane wall flashing: Manufacturer's "WB Primer"; a water-based primer which imparts an aggressive, high tack finish on the treated substrate. Product shall have the following minimum physical properties:
   1. Flash Point: No flash to boiling point
   2. Solvent Type: Water
   3. VOC Content: Not to exceed 10 g/L
   4. Application Temperature: -4°C (25°F) and above

2.4 PENETRATIONS AND TERMINATION SEALANT

A. Joint Treatment: Refer to sealant manufacturer's recommendations.

B. Liquid Membrane for Details and Terminations:

C. Manufacturer's "BITUTHENE® Liquid Membrane"; a two-part, elastomeric, trowel grade material designed for use with self-adhered membranes and tapes. 10 g/L max. VOC content.

D. Manufacturer's "BITUTHENE® Mastic" is designed to seal terminations, edges of patches and overlaps in detail areas. 225 g/L max. VOC content

E. Substrate Patching Membrane:
   1. Manufacturer's "BITUTHENE® Liquid Membrane"; a two-part, elastomeric, trowel grade material designed for use with self-adhered membranes and tapes. 10 g/L max. VOC content.

2.5 AIR BARRIER ACCESSORIES

A. Sealant: Two-part, elastomeric, trowel grade material designed for use with self-adhered membranes and tapes. 10 g/l max. VOC Content.

2.6 DRAINAGE MAT BEHIND CEMENT PLASTER (BUILDING # 6)

A. Manufacturers: The basis of design products indicated are from Stru-O-Flex International, Inc. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product and are approved by the Architect.

B. Cavity Drainage Mat Material: Free-draining mesh, fabricated from polymer fused entangled filaments bonded to a moisture resistant fiber fabric on the outer surfaces and that will not degrade within the wall cavity.
   1. Basis of Design: The basis of design products “WaterWay Rainscreen and Ventilation Drainage Mats” are manufactured by Stuc-O-Flex International, Inc. Equal or better performing products of other manufacturers will be considered for acceptance by the Architect.
   2. Mats: Mats shall be 1/8” (3mm) thick.
   3. Fasteners: Fasteners suitable for substrate, stainless steel and as approved by the mat manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrates and conditions are ready to accept the Work of this section. Notify engineer in writing of any discrepancies. Commencement of the Work or any parts thereof shall mean acceptance of the prepared substrates.

B. All surfaces must be sound, dry, clean, and free of oil, grease, dirt, excess mortar, or other contaminants detrimental to the adhesion of the membranes. Fill voids, gaps, and spalled areas in substrate to provide an even plane. Strike masonry joints full-flush.

C. Curing compounds or release agents used in concrete construction must be resin based without oil, wax, or pigments.

3.2 PREPARATION

A. Refer to manufacturer’s literature for requirements for preparation of substrates. Surfaces shall be sound and free of voids, spalled areas, loose aggregate, and sharp protrusions. Remove contaminants such as grease, oil, and wax from exposed surfaces. Remove dust, dirt, loose stone, and debris. Use repair materials and methods that are acceptable to manufacturer of the fluid-applied waterproofing.

B. Exterior sheathing panels: Ensure that the boards are sufficiently stabilized with corners and edges fastened with appropriate screws in accordance with exterior sheathing manufactures written instructions.

C. Masonry Substrates: Apply air and vapor barrier over concrete block and brick with smooth trowel-cut mortar joints, struck full and flush. Fill all voids and holes, particularly in the mortar joints, with a lean mortar mix, non-shrinking grout or parge coat.

D. Related Materials: Treat construction joints and install flashing as recommended by manufacturer.

E. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air barrier application.

F. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

G. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate patching membrane.

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H. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

I. At changes in substrate plane, apply sealant or BITUTHENE® Liquid Membrane at sharp corners and edges to form a smooth transition from one plane to another

J. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier

3.3 AIR BARRIER MEMBRANE INSTALLATION

A. Refer to manufacturer’s literature for recommendations on installation.

B. Apply air barrier membrane to achieve a continuous air barrier according to air barrier manufacturer's written instructions.

C. Application of Self-Adhered Air Barrier Membrane.
   1. Install air barrier to dry surfaces at air and surface temperatures of -4°C (25°F) and above in accordance with manufacturer's recommendations, at locations indicated on Construction Documents.
   2. Priming the substrate is not required however can be used as an optional step in certain circumstances, apply per the manufacturer’s written instructions.
   3. Precut pieces of air barrier into easily handled lengths.
   4. Remove release linear and position membrane carefully before placing against the surface. Can be applied vertically or horizontally.
   5. Begin installation at the base of the wall placing top edge of membrane immediately below any masonry reinforcement or ties protruding from substrate.
   6. When properly positioned, place against surface by pressing firmly into place. Roll membrane with extension-handled countertop roller immediately after placement.
   7. Overlap adjacent pieces 50 mm 2 inch (50.8 mm).) and roll seams.
   8. Subsequent sheets of membrane applied above shall be positioned immediately below masonry reinforcement or ties. Bottom edge shall be slit to fit around reinforcing wires or ties, and membrane shall overlap the membrane sheet below by 50 mm 2 inch (50.8 mm).). Roll firmly into place.
   9. Seal around masonry reinforcing or ties and all penetrations with penetration & termination sealant.
   10. Coordinate the installation of air barrier with roof installer to ensure continuity of membrane with roof air barrier.
   11. At end of each working day seal top edge of air barrier to substrate with termination sealant.
   12. Do not expose air barrier membrane to sunlight for more than 6 months prior to enclosure.
   13. Inspect installation prior to enclosing and repair punctures, damaged areas, and inadequately lapped seams with a patch of the membrane sized to extend 150 mm 6 inch (152.4 mm).) in all directions from the perimeter of the affected area.

3.4 TRANSITION MEMBRANE INSTALLATION

A. Install strips, transition membrane, and auxiliary materials according to air barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier. Install all transition membrane only after application of air barrier.

B. Apply primer to substrates to receive transition membrane at required rate and allow to dry. Limit priming to areas that will be covered by transition tape in same day. Re-prime areas exposed for more than 24 hours.
   1. Prime glass-fiber-surfaced gypsum sheathing not covered with air membrane material with number of prime coats needed to achieve required bond, with adequate drying time between coats.

C. Connect and seal exterior wall air barrier membrane continuously to roofing membrane air barrier, concrete below-grade structures, floor-to floor construction, exterior glazing and window systems,

glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

D. At end of each working day, seal top edge transition membrane to substrate with termination sealant.

E. Apply joint sealants forming part of air barrier assembly within sealant manufacturer's recommended application temperature ranges. Consult sealant manufacturer when sealant cannot be applied within these temperature ranges.

F. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air barrier membrane with foam sealant.

G. Repair punctures, voids, and deficient lapped seams in transition membrane. Slit and flatten fish-mouths and blisters. Patch with transition membrane extending 6 inches (152.4 mm) beyond repaired areas in strip direction.

3.5 INSTALLATION OF DRAINAGE MAT BEHIND CEMENT PLASTER (BUILDING # 6)

A. For vertical applications work from a corner. Wrap the building completely, stopping at wall ends. Ends should be terminated at a furring strip of matching thickness to prevent air movement to adjoining wall. Butt edges of the mat together. Do not overlap.

B. At window and door openings install mat tightly to casings. Take care not to cut or damage weather-resistive barrier.

C. At the bottom of the mat, place a foundation weep screed, a “J’ weep screed, or flashing with weeps. Weather-resistive barrier and mat should be placed over top of the back piece of the weep screed, termination bar, or flashing to create the proper weather lap.

D. At wall terminations, place a wood termination strip along the outside edge of each wall to create a wind dam for negative wind load.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Owner may engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Inspections: Barrier materials and installation are subject to inspection for compliance with requirements. Inspections may include the following:

1. Continuity of barrier system has been achieved throughout the building envelope with no gaps or holes.
2. Continuous structural support of barrier system has been provided.
3. Masonry and concrete surfaces are smooth, clean and free of cavities, protrusions, and mortar droppings.
4. Site conditions for application temperature and dryness of substrates have been maintained.
5. Maximum exposure time of materials to UV deterioration has not been exceeded.
6. Surfaces have been primed, if applicable.
7. Laps in strips and transition membrane have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fish-mouths.
8. Termination sealant has been applied on cut edges.
9. Strips and transition membrane have been firmly adhered to substrate.
10. Compatible materials have been used.
11. Transitions at changes in direction and structural support at gaps have been provided.
12. Connections between assemblies (membrane and sealants) have complied with requirements for cleanliness, preparation and priming of surfaces, structural support, integrity, and continuity of seal.
13. All penetrations have been sealed.

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C. Tests: Testing to be performed will be determined by Owner's testing agency from among the following tests:
   1. Qualitative Testing: Barrier assemblies will be tested for evidence of air leakage and moisture permanence according to ASTM E1186.

D. Remove and replace deficient barrier components and retest as specified above.

3.7 PROTECTION AND CLEANING

A. Protect air barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

B. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. Remove and replace air barrier exposed for more than 150 days.

C. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.

D. Remove masking materials after installation.

END OF SECTION

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SECTION 07 41 13 - METAL ROOF PANELS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Insulated metal roof panel system of preformed steel panels.

B. Insulated metal roof panel system of preformed aluminum panels.

C. Metal roof panel system of preformed steel panels.

D. Metal roof panel system of preformed aluminum panels.

1.3 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

B. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

C. ASTM A463/A463M - Standard Specification for Steel Sheet, Aluminum-Coated, by the Hot-Dip Process; 2025b.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

E. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2025a.

F. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2025.

G. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

H. ASTM C1363 - Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus; 2024.

I. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2017 (Reapproved 2023).

J. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2025.

K. ASTM D4869/D4869M - Standard Specification for Asphalt-Saturated Organic Felt Underlayment Used in Steep Slope Roofing; 2016a (Reapproved 2025).

L. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

M. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

N. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings; 2025.

O. ASTM E1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference; 2025.

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P. ASTM E1646 - Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference; 1995 (Reapproved 2024).

Q. ASTM E1680 - Standard Test Method for Rate of Air Leakage through Exterior Metal Roof Panel Systems; 2016 (Reapproved 2022).

R. IAS AC472 - Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems; 2024.

S. ICC-ES AC188 - Acceptance Criteria for Roof Underlayments; 2023.

T. ICC-ES AC207 - Acceptance Criteria for Polypropylene Roof Underlayments; 2012, with Editorial Revision (2015).

U. UL 580 - Standard for Tests for Uplift Resistance of Roof Assemblies; Current Edition, Including All Revisions.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements, for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 – Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 – Product Requirements for substitution procedures.

C. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Summary of test results, indicating compliance with specified requirements.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Specimen warranty.

D. Shop Drawings: Include layouts of roof panels, details of edge and penetration conditions, spacing and type of connections, flashings, underlayments, and special conditions.
   1. Show work to be field-fabricated or field-assembled.
   2. Include structural analysis signed and sealed by qualified structural engineer, indicating compliance of roofing system to specified loading conditions.

E. Verification Samples: For each roofing system specified, submit samples of minimum size 12 inches (305 mm) square, representing actual roofing metal, thickness, profile, color, and texture.
   1. Include typical panel joint in sample.
   2. Include typical fastening detail.

F. Manufacturer's qualification statement.

G. Installer's qualification statement.

H. Test Reports: Indicate compliance of metal roofing system to specified requirements.

I. Warranty: Submit specified manufacturer's warranty and ensure that forms have been completed in Owner's name and are registered with manufacturer.

J. Exterior Product Approvals: Manufacturer shall submit documentation that product complies with large and small missile impact criteria and has been tested and approved in compliance with Florida Product Approval or Miami Dade NOA and applicable requirements.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section and with at least three years of documented experience.
   1. Accredited by IAS in accordance with IAS AC472.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

C. Exterior Product Approvals: Manufacturer shall certify that product complies with large and small missile impact criteria and has been tested and approved in compliance with Florida Product Approval or Miami Dade NOA and applicable requirements.

1.7 MOCK-UPS

A. Provide mock-up of ___ sq ft (___ sq m), including underlayment, eave protection membrane, and associated flashings.

B. Locate as directed by Architect.

C. Mock-up may remain as part of the work.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Provide strippable plastic protection on prefinished roofing panels for removal after installation.

B. Store roofing panels on project site as recommended by manufacturer to minimize damage to panels prior to installation.

1.9 FIELD CONDITIONS

A. Do not install metal roof panels, eave protection membrane, underlayment, or _____ when surface, ambient air, or wind chill temperatures are below 45 degrees F (7 degrees C).

1.10 WARRANTY

A. Finish Warranty: Provide 5-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.

B. Special Warranty: Provide 2-year warranty for weathertightness of roofing system, including agreement to repair or replace metal roof panels that fail to keep out water commencing on the Date of Substantial Completion. Complete forms in Owner's name and register with warrantor.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Structural Metal Roof Panel Manufacturers:
1. IMETCO; ZIP RIB: www.imetco.com/#sle.
2. MBCI, a Cornerstone Building Brands Company; 7.2 Panel: www.mbci.com/#sle.
3. Taylor Metal Products; BR - 36: www.taylormetal.com/#sle.
4. Substitutions: See Section 01 60 00.0 - Product Requirements.

B. Structural Metal Roof Insulated Panel Manufacturers:
1. All Weather Insulated Panels, a Vicwest company: www.awipanels.com/#sle.
2. ATAS International, Inc; Isoleren RL: www.atas.com/#sle.
3. Centria, a Nucor Company: www.centria.com/#sle.
4. Green Span Profiles; RidgeLine: www.greenspanprofiles.com/#sle.
5. Kingspan Insulated Panels; KingRib Insulated Roof Panel: www.kingspan.com/#sle.
6. Metl-Span, a Nucor Company: www.metlspan.com/#sle.
7. Substitutions: See Section 01 60 00.0 - Product Requirements.

C. Architectural Metal Roof Panel Manufacturers:
1. ATAS International, Inc; Colonial Seam: www.atas.com/#sle.
2. Berridge Manufacturing Company; Cee-Lock Panel: www.berridge.com/#sle.
3. Construction Metal Products, Inc; Series 1000: www.cmpmetalsystems.com/#sle.
4. Drexel Metals Inc: www.drexmet.com/#sle.
5. Elevate: www.holcimelevate.com/#sle.
6. Englert, Inc; A1300: www.englertinc.com/#sle.
7. Fabral; Stand N Seam: www.fabral.com/#sle.
8. IMETCO: www.imetco.com/#sle.

9. MBCI, a Cornerstone Building Brands Company; 5V Crimp Panel: www.mbci.com/#sle.
10. Metal Roofing Systems, Inc; System 1000 - Metal Roof Panels: www.metalroofingsystems.biz/#sle.
11. Metl-Span, a Nucor Company: www.metlspan.com/#sle.
12. MS Metal Sales, a Cornerstone Building Brands Company: www.metalsales.com/#sle.
13. Petersen Aluminum Corporation; PAC T-250 Panel: www.pac-clad.com/#sle.
14. Sheffield Metals International; SMI 1.75" SnapLock Standing Seam: www.sheffieldmetals.com/#sle.
15. Taylor Metal Products; Versa Span: www.taylormetal.com/#sle.
16. Substitutions: See Section 01 60 00.0 - Product Requirements.

D. Metal Soffit Panels Manufacturers:
1. ATAS International, Inc: www.atas.com/#sle.
2. Berridge Manufacturing Company: www.berridge.com/#sle.
3. Elevate: www.holcimelevate.com/#sle.
4. Englert, Inc: www.englertinc.com/#sle.
5. Fabral: www.fabral.com/#sle.
6. MBCI, a Cornerstone Building Brands Company; Artisan Panel: www.mbci.com/#sle.
7. McElroy Metal: www.mcelroymetal.com/#sle.
8. Metal Roofing Systems, Inc: www.metalroofingsystems.biz/#sle.
9. Petersen Aluminum Corporation; PAC-850 Soffit: www.pac-clad.com/#sle.
10. Sheffield Metals International: www.sheffieldmetals.com/#sle.
11. Substitutions: See Section 01 60 00.0 - Product Requirements.

E. Retrofit Roof Panels:
1. MBCI, a Cornerstone Building Brands Company; Retro-R Panel: www.mbci.com/#sle.
2. Substitutions: See Section 01 60 00.0 - Product Requirements.

2.2 PERFORMANCE REQUIREMENTS

A. Metal Roof Panels: Provide complete roofing assemblies, including roof panels, clips, fasteners, connectors, and miscellaneous accessories, tested for compliance with the following minimum standards:
1. Structural Design Criteria: Provide panel assemblies designed to safely support design loads at support spacing indicated, with deflection not to exceed L/180 of span length(L) when tested in accordance with ASTM E1592.
a. Dead Loads: Weight of roofing system.
b. Live Loads: As required by ASCE 7.
2. Overall: Complete weathertight system tested and approved in accordance with ASTM E1592.
3. Wind Uplift: Class 90 wind uplift resistance of UL 580.
4. Air Infiltration: Maximum 0.06 cfm/sq ft (1.1 cu m/hr/sq m) at air pressure differential of 6.24 lbf/sq ft (300 Pa), when tested according to ASTM E1680.
5. Water Penetration: No water penetration when tested in accordance with procedures and recommended test pressures of ASTM E1646; perform test immediately following air infiltration test.
6. Thermal Movement: Design system to accommodate without deformation anticipated thermal movement over ambient temperature range of 100 degrees F (56 degrees C).
7. Thermal Resistance: Provide throughout system, R-value (RSI-value) of 15 (2.6) at 2 inch (51 mm) thick, minimum, when tested in accordance with ASTM C1363.

2.3 STRUCTURAL METAL ROOF PANELS

A. General: Provide complete engineered system complying with specified requirements and capable of remaining weathertight while withstanding anticipated movement of substrate and thermally induced movement of roofing system.

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B. Structural Metal Panels: Factory-formed panels with factory-applied finish.
   1. Steel Panels:
      a. Zinc-coated SS (structural steel) sheet complying with ASTM A653/A653M; minimum G60 (Z180) galvanizing.
      b. Aluminum-zinc alloy-coated SS (structural steel) sheet complying with ASTM A792/A792M; minimum AZ50 (AZM150) coating.
      c. Aluminum-coated SS (structural steel) sheet complying with ASTM A463/A463M; minimum Type 2 T2-65 (T2M-200) coating.
      d. Steel Thickness: Minimum 24 gauge, 0.024 inch (0.61 mm).
   2. Aluminum Panels:
      a. Alloy: Aluminum complying with ASTM B209/B209M; temper as required for forming.
      b. Thickness: Minimum 20 gauge, 0.032 inch (0.8 mm).
   3. Profile: Standing seam, with minimum 1-inch (25 mm) seam height; concealed fastener system for field seaming with special tool.
   4. Length: As indicated on drawings.
   5. Width: Maximum panel coverage of 36 inches (914 mm).
   6. Mill-Finish Steel Panels: Treat with passivating chemical prior to shipment to inhibit formation of corrosion.

C. Structural Insulated Metal Panels: Factory-formed panels with factory-applied finish.
   1. Type: Double-skin, factory assembled with foamed-in-place polyurethane insulation.
      a. Thickness: 2 inches (51 mm), nominal.
   2. Steel Panels:
      a. Zinc-coated SS (structural steel) sheet complying with ASTM A653/A653M; minimum G60 (Z180) galvanizing.
      b. Aluminum-zinc alloy-coated SS (structural steel) sheet complying with ASTM A792/A792M; minimum AZ50 (AZM150) coating.
      c. Aluminum-coated SS (structural steel) sheet complying with ASTM A463/A463M; minimum Type 2 T2-65 (T2M-200) coating.
      d. Steel Thickness: Minimum 24 gauge, 0.024 inch (0.61 mm).
   3. Aluminum Panels:
      a. Alloy: Aluminum complying with ASTM B209/B209M; temper as required for forming.
      b. Thickness: Minimum 20 gauge, 0.032 inch (0.8 mm).
   4. Profile: Standing seam, with minimum 1-inch (25 mm) seam height; concealed fastener system for field seaming with special tool.
   5. Texture: Smooth.
   6. Length: As indicated on drawings.
   7. Width: Maximum panel coverage of 16 inches (406 mm).
   8. Mill-Finish Steel Panels: Treat with passivating chemical prior to shipment to inhibit formation of corrosion.

D. Metal Soffit Panels:
   1. Profile: Style as indicated, with venting not provided.
   2. Material: Precoated steel sheet, 22-gauge, 0.0299-inch (0.76 mm) minimum thickness.
   3. Material: Precoated aluminum sheet, 20-gauge, 0.032-inch (0.81 mm) minimum thickness.
   4. Color: As selected by Architect from manufacturer's full line.

E. Retrofit Roof Panels:
   1. Profile: Style as indicated.
   2. Side Seams: Lapped.
   3. Condensation Control: Factory-applied membrane to reduce drips resulting from backside condensation.
   4. Material: Precoated steel sheet, 22-gauge, 0.0299-inch (0.76 mm) minimum thickness.

5. Material: Precoated aluminum sheet, 20-gauge, 0.032-inch (0.81 mm) minimum thickness.
6. Color: As selected by Architect from manufacturer's full line.

2.4 METAL ROOF PANELS

A. Metal Roof Panels: Provide complete engineered system complying with specified requirements and capable of remaining weathertight while withstanding anticipated movement of substrate and thermally induced movement of roofing system.

B. Metal Panels: Factory-formed panels with factory-applied finish.
1. Steel Panels:
a. Zinc-coated steel complying with ASTM A653/A653M; minimum G60 (Z180) galvanizing.
b. Aluminum-zinc alloy-coated steel complying with ASTM A792/A792M; minimum AZ50 (AZM150) coating.
c. Aluminum-coated steel complying with ASTM A463/A463M; minimum Type 2 T2-65 (T2M-200) coating.
d. Steel Thickness: Minimum 24 gauge, 0.024 inch (0.61 mm).
2. Aluminum Panels:
a. Alloy and Temper: Aluminum complying with ASTM B209/B209M; temper as required for forming.
b. Thickness: Minimum 20 gauge, 0.032 inch (0.81 mm).
3. Profile: Standing seam, with minimum 1-inch (25.4 mm) seam height; concealed fastener system for field seaming with special tool.
4. Texture: Smooth.
5. Length: As indicated on drawings.
6. Width: Maximum panel coverage of 24 inches (610 mm).
7. Mill-Finish Steel Panels: Treat with passivating chemical prior to shipment, to inhibit formation of corrosion.

C. Metal Soffit Panels:
1. Profile: Style as indicated, with venting provided.
2. Material: Precoated steel sheet, 22 gauge, 0.0299 inch (0.76 mm) minimum thickness.
3. Material: Precoated aluminum sheet, 20 gauge, 0.032 inch (0.81 mm) minimum thickness.
4. Color: As selected by Architect from manufacturer's full line.

2.5 ATTACHMENT SYSTEM

A. Concealed System: Provide manufacturer's standard stainless steel or nylon-coated aluminum concealed anchor clips designed for specific roofing system and engineered to meet performance requirements, including anticipated thermal movement.

B. Exposed System: Provide manufacturer's recommended stainless steel fasteners engineered to meet performance requirements and equipped with appropriate sealant separators to provide weathertight connections that will accommodate anticipated thermal movement.

2.6 SECONDARY FRAMING

A. Miscellaneous Secondary Framing: Light gauge steel framing incidental to structural supports; fabricated from steel sheet.

B. Secondary Framing for Roof Retrofit: Light gauge, asymmetrical section, steel zee profile framing precut with notches that match size, shape and spacing of existing metal roof seams.
1. Products:
a. IMETCO; IntelliFrame RF: www.imetco.com/#sle.
b. MBCI, a Cornerstone Building Brands Company; Roof Hugger: www.mbci.com/#sle.
c. Substitutions: See Section 01 60 00.0 - Product Requirements.

C. Framing Material: ASTM A1011/A1011M Designation SS steel sheet.
   1. Profile: Manufacturer's standard cee, zee, asymmetrical zee, hat channel, plain channel, single slope eave strut, double slope eave strut, and angle.
   2. Thickness: 12 gauge, 0.1046 inch (2.657 mm).
   3. Finish: Galvanized per ASTM A653/A653M, G90.

D. Framing Connectors: Factory-made formed steel sheet, ASTM A653/A653M SS Grade 50, with G60/Z180 hot dipped galvanized coating and factory punched holes.

2.7 FABRICATION

A. Panels: Provide factory or field fabricated panels with applied finish and accessory items, using manufacturer's standard processes as required to achieve specified appearance and performance requirements.

B. Joints: Provide captive gaskets, sealants, or separator strips at panel joints to ensure weathertight seals, eliminate metal-to-metal contact, and minimize noise from panel movements.

2.8 FINISHES

A. Fluoropolymer Coil Coating System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, and at least 80 percent of coil coated metal surfaces having minimum total dry film thickness (DFT) of 0.9 mil, 0.0009 inch (0.023 mm); color and gloss as selected by Architect from manufacturer’s standard line.
   1. Products:
      a. Arkema, Inc; Kynar 500: www.arkema.com/#sle.
      b. Beckers Group; Beckry Fluor: www.beckers-group.com/#sle.
      c. PPG; Duranar: www.ppgmetalcoatings.com/#sle.
      d. Sherwin-Williams Company; Fluropon: www.coil.sherwin.com/#sle.
      e. Substitutions: See Section 01 60 00.0 - Product Requirements.

B. Siliconized Polyester Coating: Epoxy primer and silicone-modified polyester (SMP) enamel topcoat with minimum dry film thickness (DFT) of 0.8 mil (0.02 mm); color and gloss as indicated on drawings.

C. Acrylic Enamel Coating: Epoxy primer and acrylic enamel topcoat with minimum dry film thickness (DFT) of 0.8 mil (0.02 mm); color and gloss as indicated on drawings.

D. Solar Reflectance Index (SRI): 82, Initial, less than 2:12 low-sloped roof.

2.9 ACCESSORIES

A. Miscellaneous Sheet Metal Items: Provide flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, and equipment curbs of the same material, thickness, and finish as used for the roofing panels. Items completely concealed after installation may optionally be made of stainless steel.
   1. Downspouts:
      a. Profile: Square; Minimum size 6" x 6"
      b. Material: Stainless steel.
   2. Gutters:
      a. Profile: Square; Minimum size 8" x 8"
      b. Material: Stainless steel.

B. Rib and Ridge Closures: Provide prefabricated, close-fitting components of steel with corrosion resistant finish or combination steel and closed-cell foam.

C. Sealants:
   1. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.

2. Concealed Sealant: Non-curing butyl sealant or tape sealant.
3. Seam Sealant: Factory-applied, non-skinning, non-drying type.

D. Thermal Insulation: Provide flexible blanket, rigid, or semi-rigid type, faced with white, flexible, non-dusting vapor retarder tested for maximum flame spread index of 50, per ASTM E84; for installation using spacer blocks.
1. Thickness: As indicated.
2. Thermal Resistance: Minimum, R-value of 9.4 (RSI of 1.7).

E. Underlayment for Wood Substrate: ASTM D226/D226M roofing felt, perforated type; covered by water-resistant rosin-sized building paper.

F. Underlayment: Synthetic non-asphaltic sheet, intended by manufacturer for mechanically fastened roofing underlayment without sealed seams.
1. Type: Woven polypropylene with anti-slip polyolefin coating on both sides.
2. Minimum Requirements: Comply with ICC-ES AC188 for non-self-adhesive sheet.
3. Minimum Requirements: Comply with ICC-ES AC207 for non-self-adhesive sheet.
4. Self Sealability: Nail sealability in accordance with ASTM D1970/D1970M.
5. Flammability: Minimum of Class A, in accordance with ASTM E108 test method.
6. Low Temperature Flexibility: Comply with ASTM D1970/D1970M.
7. Water Vapor Permeance: 1 perm (57.2 ng/(Pa s sq m)), maximum, when tested in accordance with ASTM E96/E96M, Desiccant Method A.
8. Performance: Comply with ASTM D226/D226M, Type II asphalt-saturated organic felt.
9. Liquid Water Transmission: Comply with ASTM D4869/D4869M.
10. Functional Temperature Range: Minus 70 degrees F (56.7 degrees C) to 212 degrees F (100 degrees C).
11. Fasteners: As specified by manufacturer and building code qualification report or approval.

G. Underlayment: Self-adhering polymer modified asphalt sheet complying with ASTM D1970/D1970M, with strippable release film and top surface of woven polypropylene sheet.
1. Minimum Requirements: Comply with requirements of ICC-ES AC188 for non-self-adhesive sheet.
2. Sheet Thickness: 22 mils, 0.022 inch (0.55 mm), minimum.
3. Self Sealability: Nail sealability in accordance with ASTM D1970/D1970M.
4. Low Temperature Flexibility: Comply with ASTM D1970/D1970M.
5. Water Vapor Permeance: 0.1 perm (5.72 ng/Pa s sq m), maximum, when tested in accordance with ASTM E96/E96M using Desiccant Method (Method A).
6. Functional Temperature Range: Minus 45 degrees F (Minus 42.8 degrees C) to 250 degrees F (121 degrees C).
7. Products:
   a. Certainteed Roofing; WinterGuard HT - High Temperature Waterproofing Underlayment: www.certainteed.com/#sle.
   b. GAF; FT Solutions Performance SA Leak Barrier: www.ftsolutionsroof.com/#sle.
   c. Henry, a Carlisle Company; Blueskin RF200: www.henry.com/#sle.
   d. Henry, a Carlisle Company; Blueskin PE200HT: www.henry.com/#sle.
   e. Polyglass USA, Inc; Polystick MTS Self-Adhered High Temperature Roof Underlayment: www.polyglass.us/#sle.
   f. Protecto Wrap Company: www.protectowrap.com/#sle.
   g. System Components Corporation, Inc; FelTex SA300: www.systemcomponents.net/#sle.
   h. Substitutions: See Section 01 60 00.0 - Product Requirements.

H. Underlayment: Self-adhering butyl sheet complying with ASTM D1970/D1970M, with strippable release film and walkable top surface.

1. Functional Temperature Limit: Up to 265 degrees F (130 degrees C).
2. Products:
   a. GAF; FT Solutions Premier Butyl Leak Barrier: www.ftsolutionsroof.com/#sle.
   b. Substitutions: See Section 01 60 00.0 - Product Requirements.

I. Underlayment: Self-adhering polymer modified sheet; 20 mil (0.51 mm) total thickness; with strippable siliconized release film on bottom side and slip resistant and UV-stable facing on top side.
   1. Self Sealability: Nail sealability in accordance with ASTM D1970/D1970M.
   2. Water Vapor Permeance: 30 perm (1716 ng/(Pa s sq m)), maximum, when tested in accordance with ASTM E96/E96M, Desiccant Method A.
   3. Functional Temperature Range: From minus 40 degrees F (minus 40 degrees C) to 250 degrees F (121 degrees C).
   4. Products:
      a. Certainteed Roofing; DryRoof SA - Self-Adhered: www.certainteed.com/#sle.
      b. Elevate; CLAD-GARD R Metal Underlayment: www.holcimelevate.com/#sle.
      c. VaproShield, LLC; SlopeShield Plus Self-Adhered: www.vaproshield.com/#sle.

J. Ventilation Mat, Applied Over Underlayment: Nylon mesh fabric.
   1. Thickness: 3/8 inch (9.5 mm), nominal.
   2. Products:
      a. Advanced Building Products, Inc; R-Vent: www.advancedbuildingproducts.com/#sle.
      b. Freudenberg Performance Materials; EnkaMat ASV: www.freudenberg-pm.com/#sle.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation of preformed metal roof panels until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Broom clean wood sheathing prior to installation of roofing system.

B. Coordinate roofing work with provisions for roof drainage, flashing, trim, penetrations, and other adjoining work to ensure that completed roof will be free of leaks.

C. Coordinate installation of waterproof membrane over roof sheathing with Section 06 10 00.

D. Remove protective film from surface of roof panels immediately prior to installation; strip film carefully to avoid damage to prefinished surfaces.

E. Separate dissimilar metals by applying a bituminous coating, self-adhering rubberized asphalt sheet, or other permanent method approved by metal roof panel manufacturer.

F. Protect surrounding areas and adjacent surfaces from damage during execution of this work.

G. At locations where metal will be in contact with wood or other absorbent material subject to wetting, seal joints with sealing compound and apply one coat of heavy-bodied bituminous paint.

3.3 INSTALLATION

A. Overall: Install roofing system in accordance with approved shop drawings and metal roof panel manufacturer's instructions and recommendations, as applicable to specific project conditions; securely anchor components of roofing system in place allowing for thermal and structural movement.
   1. Install roofing system with concealed clips and fasteners, except as otherwise recommended by manufacturer for specific circumstances.

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2. Install roofing system with exposed fasteners prefinished to match panels.
3. Minimize field cutting of panels. Where field cutting is required, use methods that will not distort panel profiles. Use of torches for field cutting is prohibited.

B. Accessories: Install necessary components that are required for complete roofing assembly, including flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, equipment curbs, rib closures, ridge closures, and similar roof accessory items.

C. Install roofing felt and building paper slip sheet on roof sheathing before installing preformed metal roof panels; secure by methods acceptable to roof panel manufacturer, minimizing use of metal fasteners; apply from eaves to ridge in shingle fashion, overlapping horizontal joints at least 2 inches (50 mm) and side and end laps at least 3 inches (75 mm); offset seams in building paper and seams in roofing felt.

D. Roof Panels: Install metal roof panels in accordance with manufacturer's installation instructions, minimizing transverse joints except at junction with penetrations.
1. Form weathertight standing seams incorporating concealed clips, using an automatic mechanical seaming device approved by panel manufacturer.
2. Provide concealed clips at panel joints, and apply snap-on battens to provide weathertight joints.
3. Provide sealant tape or other approved joint sealer at lapped panel joints.
4. Install sealant or sealant tape at end laps and side joints as recommended by metal roof panel manufacturer.

E. Insulation: Install insulation between roof covering and supporting members to present a neat appearance; fold, staple, and tape seams unless otherwise approved by Architect.
1. Install rigid or semi-rigid insulation in areas exposed to view.

3.4 CLEANING

A. Clean exposed sheet metal work at completion of installation. Remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving the work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to the finish.

3.5 PROTECTION

A. Do not permit storage of materials or roof traffic on installed roof panels. Provide temporary walkways or planks as necessary to avoid damage to completed work. Protect roofing until completion of project.

B. Touch-up, repair, or replace damaged roof panels or accessories before Date of Substantial Completion.

END OF SECTION

SECTION 07 42 13 - METAL WALL AND SOFFIT PANELS

PART 2 PRODUCTS

1.1 METAL WALL PANEL SYSTEM

A. Wall Panel System: Factory fabricated prefinished metal panel system, site assembled.
   1. Provide exterior wall panels, interior liner panels, soffit panels, retrofit wall panels, and subgirt framing assembly.
   2. Design and size components to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of wall.
   3. Maximum Allowable Deflection of Panel: L/180 for length(L) of span.
   4. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.
   5. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
   6. Fabrication: Formed true to shape, accurate in size, square, and free from distortion or defects; pieces of longest practical lengths.
   7. Corners: Factory-fabricated in one continuous piece with minimum 2-inch (51 mm) returns.

B. Exterior Wall Panels:
   1. Profile: Vertical; style as indicated.
   2. Side Seams: Double-interlocked, tight-fitting, sealed with continuous gaskets.
   3. Panel Width: ___ inches (___ mm).

C. Interior Liner Panels:
   1. Profile: Vertical; style as indicated.
   2. Side Seams: Interlocking, sealed with continuous bead of sealant.
   3. Panel Width: ___ inch (___ mm).

D. Soffit Panels:
   1. Profile: Style as indicated, with venting provided.

E. Retrofit Wall Panels:
   1. Profile: Vertical; style as indicated.
   2. Side Seams: Lapped.
   3. Condensation Control: Factory-applied membrane to reduce drips resulting from backside condensation.
   4. Panel Width: ___ inches (___ mm).

F. Subgirt Framing Assembly:

G. Internal and External Corners: Same material, thickness, and finish as exterior sheets; profile to suit system; shop cut and factory mitered to required angles.

H. Expansion Joints: Same material, thickness and finish as exterior sheets; ___ gauge, ___ inch (___ mm) thick; manufacturer's standard brake formed type, of profile to suit system.

I. Trim: Same material, thickness and finish as exterior sheets; brake formed to required profiles.

J. Anchors: Galvanized steel.

END OF SECTION

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SECTION 07 52 00 - MODIFIED BITUMEN MEMBRANE ROOFING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, materials, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Multi-ply modified bitumen roofing system.
   2. Rigid insulation.
   3. Cover board.
   4. Walkway Surfacing.

1.3 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.

B. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

C. ASCE 7-10 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; 2010.

D. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2023a.

E. ASTM D41/D41M - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing; 2011 (Reapproved 2023).

F. ASTM D1079 - Standard Terminology Relating to Roofing and Waterproofing; 2026a.

G. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2019.

H. ASTM D4263 - Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method; 1983 (Reapproved 2018).

I. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2018).

J. ASTM D4601/D4601M - Standard Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing; 2004 (Reapproved 2020).

K. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings; 2025.

L. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2026.

M. ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces; 2011 (Reapproved 2019).

N. ASTM G154 - Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials; 2023.

O. ASTM G155 - Standard Practice for Operating Xenon Arc Lamp Apparatus for Exposure of Materials; 2025.

P. CRRC-1 - CRRC-1 Roof Product Rating Program Manual; 2026.

Q. UL 790 - Standard for Standard Test Methods for Fire Tests of Roof Coverings; Current Edition, Including All Revisions.

R. ASTM A6163-00(2008) – Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcement.

S. ASTM D312 – Standard Specification for Asphalt Used in Roofing.

T. ASTM D2178 – Standard Specification for Asphalt-Impregnated Glass Felt used in Roofing and Waterproofing.

U. ASTM E96 – Standard Test Method for Water Vapor Transmission of Materials.

V. NRCA – Roofing and Waterproofing Manual, Current Edition.

W. OSHA – Occupational Safety and Health Act.

X. UL – Fire Hazard Classifications.

Y. UL – Roofing System & Material Guide.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements, for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 – Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 – Product Requirements for substitution procedures.

C. Product Data:
1. Submit specifications, installation instructions, and general recommendations from manufacturers of roofing system materials, for type of roofing required.
2. Include data substantiating that materials comply with requirements, including list of materials proposed for use and manufacturer's product data sheets for other products.
3. Product Test Reports: For components of roofing system, for tests performed by manufacturer and witnessed by a qualified testing agency.
4. Research/Evaluation Reports: For components of roofing system, from ICC-ES.

D. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work, including:
1. Base flashings and membrane terminations.
2. Insulation tapered locations, including slopes.
3. Crickets, saddles, and tapered edge strips, including slopes.
4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
5. Provide fastening pattern layout in compliance with ASCE 7.
6. Submit complete installation details showing roof configuration, sheet layout, seam locations, flashing, roof slopes, details at each different perimeter condition and special conditions.

E. Samples For the following products:
1. Cap sheet, of color required, 12" x 12" square of membrane system
2. Flashing sheet, of color required, 12" x 12" square of membrane system.
3. Aggregate surfacing material in gradation and color required.
4. Walkway surfacing of color required.

F. Warranty: Submit sample warranty. Provide sample copies of specified warranties, including evidence of application for warranty from manufacturer. Include manufacturer's special warranties.

G. Include complete manufacturer’s instructions for periodic inspection and maintenance of roofing system in closeout documentation.

H. Qualification Data: For Installer and manufacturer.
1. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

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2. Submit evidence of compliance with performance requirements.

I. Certificates included with closeout documents:
   1. Submit Manufacturers certification that materials and components furnished conform to specified requirements and that materials furnished are compatible for decks indicated.
   2. At completion of work, submit manufacturer's certification that roofing system installation is in accordance with Manufacturer's warranty requirements.

J. Safety Provisions:
   1. Submit a complete detailed schedule of special safety provisions implemented to insure the health and safety of the people.
   2. Work shall not start without the Owner's agreement of the following provisions:
      a. A plan for a dust free operation.
      b. A plan for the sequencing of work and the removal of debris from the site during and after construction.
      c. A fall protection plan indicating the contractor plans for complying with OSHA's requirements.

K. Exterior Product Approvals: Manufacturer shall submit documentation that product complies with large and small missile impact criteria and has been tested and approved in compliance with Florida Product Approval or Miami Dade NOA and applicable requirements.

1.6 QUALITY ASSURANCE

A. Manufacturer: Obtain primary roofing materials from a single manufacturer, with at least 10-years of documented experience in the roofing material business.

B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation of specified materials and assemblies with not less than five (5) years experience.
   1. The job supervisor shall have minimum 5-years of documented experience in supervising projects of this size and scope.

C. All work shall conform to NRCA Roofing and Waterproofing Manual, and to manufacturers' instructions.

D. Inspections
   1. The roof membrane shall be inspected by the manufacturer's representative within one year of acceptance by the Owner.
   2. Provide at a minimum one in progress inspection with the Manufacturer's Representative and the Owner's Representative. The Manufacturer's Representative shall submit a written report of the inspection results within ten (10) days after the inspection to the Architect.
   3. Inspections: Provide on-site weekly inspections by Owner's representative during and after installation of roofing system.
   4. The contractor shall provide the Architect of record a "final statement of compliance" for the owner once the final inspection has been completed, stating that the finished roof membrane complies with the contractual documents.

E. Exterior Product Approvals: Manufacturer shall certify that product complies with large and small missile impact criteria and has been tested and approved in compliance with Florida Product Approval or Miami Dade NOA and applicable requirements.

1.7 PRE-INSTALLATION MEETING

A. Preinstallation Roofing Conference: Prior to installation of roofing system, conduct a pre-installation project site conference after submittal approval.

B. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.

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C. Review methods and procedures related to roofing installation, including manufacturer's written instructions.

D. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

E. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.

F. Review structural loading limitations of roof deck during and after roofing.

G. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.

H. Review governing regulations and requirements for insurance and certificates if applicable.

I. Review temporary protection requirements for roofing system during and after installation.

J. Review roof observation and repair procedures after roofing installation.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

C. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

D. Store rolled goods on end on clean raised platforms with a breathable weather protective covering, such as canvas, when stored outdoors (Polyethylene or other non-breathable plastic coverings are not acceptable.)

E. Provide continuous protection of materials against wetting and absorption; remove wet materials from project site.

F. Rooftop Storage: Disperse material evenly across the roof to avoid concentrated loading.

G. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

H. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.9 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

B. Do not apply roofing membrane to damp deck surface.

1.10 WARRANTIES

A. Manufacturer's Warranty:
   1. Provide written warranty signed by the Manufacturer of the primary roofing materials agreeing to replace or repair defective roof membrane and flashing materials and workmanship as required maintaining the roofing system in a watertight condition at no expense to the Owner for a period of 20-years after date of Final Completion of the entire Project.
   2. In addition, provide written warranty signed by the manufacturer of primary roofing materials agreeing to allow Owner to make emergency repairs to roof without voiding manufacturer's warranty.
      a. In conjunction with issuance of the above warranty, include the following:

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1) Instructions detailing preventative maintenance required to maintain the warranty.
2) Provide a list of substances, which may damage the membrane.
3) Specifications on repair of the membrane Owner may do without voiding warranty.

b. Warranty shall include coverage for damage to building resulting from failure of roof system to resist penetration of water with no dollar limit to the value of repairs or replacements covered.
c. The built-up roofing membranes and insulation as well as all accessories and appurtenances shall comprise the "Roofing System" and shall be part of a single source warranty.

3. Provide at a minimum one in progress inspection with the Manufacturer's Representative and the Owner's Representative.
4. Manufacturer's Certification:
   a. Submit written certification signed by the manufacturer stating that the roofing system manufacturer will provide warranties, inspection and Report Services specified herein.
   b. Submit warranty terms with the post-bid package.
5. Provide acceptance letter from the roofing manufacturer that this specification meets the requirements of the twenty (20) year warranty and that no criteria specified herein will impact such warranty.

B. Installer's Warranty: Provide a written two-year warranty (starting from date of the total project's substantial completion) signed by the roofing Installer and the Contractor agreeing to replace or repair defective components and workmanship of the total roofing system.
   1. Including roofing membrane, flashing, insulation, and roofing accessories as required to maintain the total roofing system in a watertight condition at no expense to the Owner.

1.11 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and base flashings shall remain watertight.
   1. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G154, or ASTM G155.
   2. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.

B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

C. Roofing System Design: Tested by a qualified testing agency to resist the following uplift pressures:
   1. Uplift Pressures: As indicated on structural plans

D. Energy Star Listing: Roofing system shall be listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.

E. Exterior Fire-Test Exposure: ASTM E108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

F. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

G. All roofing materials shall be labeled Class A per ASTM E108 and shall be certified by a nationally recognized independent testing laboratory. All roofing systems shall be installed within the limitations of the testing procedure for surfacing, deck cross slope and combustibility.

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H. Insulation and moisture protection, insulation, moisture protection, roofing, thermal requirements, fireproofing and firestopping shall be designed and constructed in compliance with the Florida Building Code and Florida Fire Prevention Code as adopted by the State Fire Marshal.

I. Provide an installed roofing membrane and base flashing system that does not permit the passage of water and will withstand the design pressures calculated in accordance with the most current revision of ASCE 7.

J. Roofing materials shall resist wind uplift forces in accordance with ASCE 7-10 with design wind speed and exposure as stated on the structural plans in accordance with FBC Chapter 36.

K. Manufacturer shall provide all primary roofing materials that are physically and chemically compatible when installed in accordance with manufacturers current application requirements.

L. Comply with Requirements of Regulatory Agencies:
   1. Underwriter's Laboratories, Inc.: Class A fire hazard classification.
   2. Roofing system shall meet current ASCE 7 wind requirements for the roofing system.
   3. Roofing system shall be designed to meet requirements in accordance with Figure 1609B, Florida Building Code.

M. Exterior Product Approvals: Manufacturer shall certify that product complies with large and small missile impact criteria and has been tested and approved in compliance with Florida Product Approval or Miami Dade NOA and applicable requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
   1. Johns Manville; https://www.jm.com/en
      a. Basis of Design Product: Florida NOA: Refer to the “Approved Products” table on drawings for Florida Product Approval and/or NOA numbers.

B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product.
   1. Soprema; https://www.soprema.us/products
   2. Siplast; https://www.siplast.com/systems

2.2 ROOFING SYSTEM

A. System Description: a three-ply system consisting of a base membrane direct-applied to the insulation, interplay and a cap membrane sheet. Includes flashing and all accessories required for roof installation.

B. Base Sheet: “Dynagrip SD/SA” ASTM D4601, SBS-Modified Asphalt impregnated and coated sheet with glass-fiber reinforcing mat.

C. Interply Sheet: “Dynaweld 180” ASTM D6164, Type 1, Grade S, SBS-Modified Asphalt impregnated and coated sheet with glass-fiber reinforcing mat.

D. Cap Sheet: “Dynaweld Cap FR CRG” ASTM D6163 Type 1, Grade G, SBS-Modified Asphalt impregnated and coated sheet with glass-fiber-reinforced mat and surfaced with bright white granules.

E. Solar Reflectance Index: Not less than an initial index of not less than 104 and an aged index of not less than 95 when calculated according to ASTM E1980, based on testing identical products by a qualified testing agency.

F. Energy Performance: Roofing system shall have an initial solar reflectance of not less than 0.83 and an emissivity of not less than 0.90 when tested according to CRRC-1.

2.3 AUXILIARY ROOFING MATERIALS

A. General: Auxiliary materials recommended by roofing manufacturer for intended use and compatible with roofing.

B. Asphalt Primer: ASTM D41/D41M.

C. Roofing Asphalt: ASTM D 312, Type III or IV as recommended by roofing manufacturer for application.

D. Flashing Adhesive: ASTM D4586 Type II asphalt-based, asbestos-free, cold-applied adhesive specially formulated for compatibility and use with flashings.

E. Asphalt Roofing Adhesive: ASTM D4479, asbestos free, of consistency required by roofing system manufacturer for application.

F. Mastic: ASTM D4586 Type II modified bitumen; non-hardening, non-migrating, non-skinning, and non-drying.

G. Fasteners: Factory-coated steel fasteners complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roofing components to substrate; tested by manufacturer for required pullout strength, and acceptable to roofing system manufacturer and as required per the product approval.

H. Fiber Cants: Fire rated, asphalt impregnated, wood fiberboard, pre-formed to 45° angle. Provide 4" vertical and horizontal minimum dimensions, mechanically attached or fastened with roofing mastic, if allowed by code.

I. Base Flashing: “Prefabricated, granule surfaced, reinforced, Styrene-Butadiene-Styrene (SBS) block copolymer modified asphalt flashing membrane. The reinforcement mat shall be impregnated and coated each side with SBS modified bitumen blend.

J. Liquid Applied Flashing: Liquid applied flexible PMMA – based monolithic membrane form by the combination of resin and fleece fabric.

K. Roofing Granules: Ceramic-coated roofing granules shall match roofing.

L. Miscellaneous Accessories: Provide accessories recommended by roofing system manufacturer.

M. Splash Pads: Provide and install precast concrete type, of sizes and profiles indicated; minimum 3000 psi (20684.28 kPa) at 28 days, with minimum 5% air entrainment.

2.4 ACCESSORIES

2.5 RIGID INSULATION

A. Manufactures: The basis of design products “ENERGY 3” are manufactured by Johns Manville. Equal or better performing products of other manufacturers will be considered for acceptance by the Architect.

B. General: Preformed flat and tapered roof insulation boards manufactured or approved by roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.

C. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1, Grade 2, glass-fiber mat facer on both major surfaces.

D. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch (6.35 mm) per 12 inches (304.8 mm) unless otherwise indicated.

E. Modified Asphaltic Insulation Adhesive: Insulation manufacturer's recommended modified asphaltic, asbestos-free, cold-applied adhesive formulated to attach roof insulation to substrate or to another insulation layer.

F. Substrate Joint Tape: 6- or 8-inch wide, coated, glass-fiber joint tape.

G. R-Value: 5.7 per inch

H. Roof R-Value: R-value shall be a minimum R-30 and as indicated on the drawings.

2.6 COVER BOARD

A. Manufactures: The basis of design products “SecureRock” are manufactured by USG. Equal or better performing products of other manufacturers will be considered for acceptance by the Architect.

B. Fiberglass-Mat Faced Cover Board: Comply with ASTM C1177/1177M.
   1. Thickness: 5/8 inch (15.88 mm).
   2. Width: 4 feet (121.92 cm).
   3. Length: 8 feet (243.84 cm).
   4. Edges: Square.
   5. Surfacing: Fiberglass mat on face, back and long edges.

2.7 WALKWAYS SURFACING

A. Walkway Surfacing: Reinforced asphaltic composition pads with slip-resisting mineral-granule surface, or polymer-modified, reconstituted rubber pads or rolls with slip-resisting textured surface, manufactured as a traffic pad for foot traffic and acceptable to roofing system manufacturer, 3/8 inch (9.52 mm) thick, minimum.
   1. Pad or Roll Size: 30” wide and as indicated on drawings.
   2. Color: to match that of roofing cap sheet.

2.8 ENVIRONMENTAL PRODUCTS

A. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use, and compatible with membrane roofing.

B. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

C. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
   1. Plastic Foam Adhesives: 50 g/L.
   2. Gypsum Board and Panel Adhesives: 50 g/L.
   3. Multipurpose Construction Adhesives: 70 g/L.
   4. Fiberglass Adhesives: 80 g/L.
   5. Contact Adhesive: 80 g/L.
   6. Other Adhesives: 250 g/L.
   7. Single-Ply Roof Membrane Sealants: 450 g/L.
   8. Nonmembrane Roof Sealants: 300 g/L.
   9. Sealant Primers for Nonporous Substrates: 250 g/L.
   10. Sealant Primers for Porous Substrates: 775 g/L.

PART 3 EXECUTION

3.1 ROOFING INSTALLATION, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions.

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

C. Install roofing and auxiliary materials to tie into existing roofing to maintain weathertightness of transition and to not void warranty for existing roofing system.

3.2 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work:

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1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
2. Verify that cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in specification section Steel Decking.
4. Verify that deck is securely fastened with no projecting fasteners and with no adjacent units in excess of 1/16 inch (1.59 mm) out of plane relative to adjoining deck.
5. Verify that substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D4263.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Do not start the installation of accessories or membrane without the presence of the Manufacturer's Technical Representative. This requirement shall not be waived.

D. Due to the incompatibility of various materials with the roofing membrane, the Representative shall inspect the substrate and shall have a barrier applied for complete separation and protection of the roofing membrane and accessories.

E. Install all drains, curbs, nailers, blocking, insulation, and projections through the roof before starting membrane installation. These items may be installed after the membrane installation only with Architect’s written approval, proper provision for re-inspection, and continued warranty protection.

F. All conduits to curb mounted equipment shall be installed inside the curbs.

G. Curbs shall be a minimum 12" high above the finished roof.

3.4 RIGID INSULATION INSTALLATION

A. Coordinate installation of roof system components so rigid insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with roofing system manufacturer's written instructions for installation of roof insulation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

D. Secure first layer according to requirements in FMG's "Approval Guide" and “RoofNav” for specified Windstorm Resistance Classification.

E. Install subsequent layers in an adhesive according to roofing system manufacturer’s instruction.

F. Install tapered insulation under area of roofing to conform to slopes indicated.

G. Install insulation boards with long joints in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6.35 mm) with like material.

H. Install one or more layers of insulation under area of roofing to achieve required thickness. Where overall thickness is 2.0 inches (50.8 mm) or greater, install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (152.4 mm) in each direction.

I. Trim surface of insulation boards where necessary at roof drains so completed surface is flush and does not restrict flow of water.

J. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

K. Insulation Cant Strips: Install and secure preformed 45-degree insulation cant strips at junctures of roofing membrane system with vertical surfaces or angle changes greater than 45 degrees per manufacturer's instruction.

3.5 COVER BOARD INSTALLATION

A. Coordinate installing membrane roofing system components so cover board is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with membrane roofing system manufacturer's written instructions for installing roof cover board.

C. Install cover board with long joints of cover board in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6.35 mm) with cover board.
   1. Cut and fit cover board within 1/4 inch (6.35 mm) of nailers, projections, and penetrations.

D. Trim surface of cover board where necessary at roof drains so completed surface is flush and does not restrict flow of water.
   1. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

E. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
   1. Fasten substrate board to top flanges of steel deck according to recommendations in FM Global's "RoofNav" and FM Global Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification.
   2. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to roofing system manufacturers' written instruction.

3.6 PREPARATION OF SUBSTRATE

A. The applicator shall carefully inspect all surfaces of insulation and cover board, and assure all surfaces are satisfactory prior to beginning installation.

B. Beginning insulation installation constitutes acceptance of substrate without recourse.

C. Roofing Membrane: The manufacturer's Technical Service Representative shall carefully inspect the substrate receiving the roofing and provide a written report.

D. Install all nails, blocking, vertical surfaces, etc. prior to proceeding with membrane installation.

E. Verify that all units are properly secured in place prior to proceeding with membrane installation.

3.7 INSTALLATION OF ROOFING MEMBRANE SYSTEM

A. Install membranes over insulation and underlayment board in accordance with accepted roofing manufacturer's specification and recommendations, and as specified below.
   1. Phased construction of roofing membrane is strictly prohibited.

B. Complete installation of modified roofing system up to line of termination of day's work.
   1. Install temporary water cut-offs of plastic cement and base sheet strips at end of each day's work.
   2. Remove upon resumption of work.

C. Base Flashing:
   1. Install in accordance with requirements of roofing system manufacturer.
   2. Install where roofing system abuts vertical surfaces and at other locations detailed.

D. Roof Edging:
   1. Prior to application of metal edging treatment, extend roofing felts up over tapered edging and secure to wood nailer with base felt extended and folded back over ply felts.
   2. After metal edging is in place, flash as recommended by roofing manufacturer.

E. Flashings: Install metal flashings in such a manner as to prevent leaks.

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F. Venting: Provide aluminum one-way vent stacks for every 1000 s.f. of roof area or as recommended by manufacturer.

G. Splash Pads Installation: Provide splash pads at locations where downspouts discharge onto the roofing membrane. Provide a 2'-0" wide by 10'-0" long splash apron under the splash pad. Splash apron shall be an addition piece of cap sheet adhered to the roofing surface.

3.8 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings.

3.9 TRAFFIC PROTECTION

A. Install walkway surfacing from all roof access locations as recommended by manufacturer to locations including roof-mounted equipment work locations and areas of repeated rooftop traffic and as indicated on the Drawings.

B. Provide a walkway surfacing around and on all sides of rooftop equipment.

C. Heat-weld or adhere walkway surfacing to the roof membrane surface continuously around the perimeter of the surfacing.

3.10 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Provide periodic inspections of roof application by qualified technical representative of roofing manufacturer.

3.11 ROOF TESTING

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and to prepare test reports.

B. Test Cuts: Test specimens will be removed to evaluate problems observed during quality-assurance inspections of roofing membrane as follows:
   1. Approximate quantities of components within roofing membrane will be determined according to ASTM D 3617.
   2. Test specimens will be examined for interply voids according to ASTM D 3617 and to comply with criteria established in Appendix 3 inch (76.2 mm) ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing."
   3. Repair areas where test cuts were made according to roofing system manufacturer's written instructions.

C. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
   1. Notify Architect and Owner 48 hours in advance of date and time of inspection.

D. Roofing system will be considered defective if it does not pass tests and inspections.
   1. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.12 CLEANING

A. Clean up debris, excess materials, and equipment and remove from site.

B. Remove bitumen from surfaces other than those requiring bituminous roof coatings.

C. Remove bituminous markings from finished surfaces.

3.13 PROTECTION

A. Provide special protection or avoid heavy traffic on completed work when ambient temperature is above 80°F.

B. Restore to original condition or replace work or materials damaged during handling of bitumen and roofing materials.

C. Do not transverse any walkways where new work has been completed where traffic must continue over finished roof membrane, protect surfaces.

D. Do not throw or drop debris from roof, use chutes, or high lift trucks.

E. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

F. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

END OF SECTION

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SECTION 07 54 23.1 - ROOFING INSTALLER'S WARRANTY

ROOFING INSTALLER'S WARRANTY

A. WHEREAS _____ of _____, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

1. Owner: (Insert name of Owner).
2. Address: (Insert address).
3. Building Name/Type: (Insert information).
4. Address: (Insert address).
5. Area of Work: (Insert information).
6. Acceptance Date: _____.
7. Warranty Period: 5 years from date of substantial completion.
8. Expiration Date: _____.

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period Roofing Installer will, at Roofing Installer's own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:
   1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
      a. lightning;
      b. peak gust wind speed exceeding [Insert mph (m/sec)];
      c. fire;
      d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
      e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
      f. vapor condensation on bottom of roofing; and
      g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
   2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
   3. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations,

attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.

4. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
5. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
6. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.

END OF SECTION

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SECTION 07 56 00 - COLD LIQUID-APPLIED FLASHINGS (PMMA, PMA)

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, materials, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:

A. Provide labor, materials, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:

1. Fully-reinforced, cold liquid-applied PMMA flashing system consisting of a cold liquid-applied reinforced waterproofing membrane and finish layers as specified.
2. Preparation of existing flashing substrates.
3. Liquid applied, reinforced flashings.
4. Optional liquid applied aesthetic surfacing.

1.3 REFERENCE STANDARDS

A. ANSI/SPRI/FM 4435/ES-1 - Test Standard for Edge Systems Used with Low Slope Roofing Systems, 2022.

B. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants, 2018.

D. ASTM D1079 - Standard Terminology Relating to Roofing and Waterproofing, 2026a.

E. ASTM D4541 - Standard Test Method for Pull-off Strength of Coatings Using Portable Adhesion Testers, 2022.

F. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes, 2019a.

G. FM 4450 — Class I Insulated Steel Deck Roofs, 1989.

H. FM 4470 - Examination Standard for Single-Ply, Polymer-Modified Bitumen Sheet, Built-Up Roof (BUR) and Liquid Applied Roof Assemblies for Use in Class 1 and Noncombustible Roof Deck Construction; 2022.

I. FM 4474 - American National Standard for Evaluating the Simulated Wind Uplift Resistance of Roof Assemblies Using Static Positive and/or Negative Differential Pressures, 2020.

J. ISO 9001 - Quality Management Systems - Requirements, 2015, with Amendment (2024).

K. PS 1 -Structural Plywood; 2023.

L. SSPC-SP 3 - Power Tool Cleaning, 2024

M. UL 790 - Standard for Standard Test Methods for Fire Tests of Roof Coverings; Current Edition, Including All Revisions.

N. UL 1256 - Standard for Fire Test of Roof Deck Constructions; 2018.

O. ASTM C836 - Standard Specification for High Solids Content, Cold Liquid applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course.

P. ANSI/SPRI FX-1 - Standard Field Test Procedure for Determining the Withdrawal Resistance of Roofing Fasteners.

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Q. ANSI/SPRI IA-1 - Standard Field Test Procedure for Determining the Mechanical Uplift Resistance of Insulation Adhesives over Various Substrates.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements, for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 DEFINITIONS

A. ASTM D1079- Standard Terminology Relating to Roofing and Waterproofing.

B. The National Roofing Contractors Association (NRCA) Roofing and Waterproofing Manual, Fifth Edition Glossary.

1.6 SUBMITTALS

A. Refer to Section 01 30 00.0 – Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 – Product Requirements for substitution procedures.

C. Product Data Sheets: Submit manufacturer’s product data sheets, installation instructions and/or general requirements for each component.

D. Safety Data Sheets: Submit manufacturer’s Safety Data Sheets (SDS) for each component.

E. Sample warranty from the manufacturer and contractor.

F. Provide roof plan and representative detail drawings.

G. Submit a letter from the roofing manufacturer indicating the contractor is an authorized applicator.

H. Warranty: Provide manufacturers and contractor’s warranties upon project completion.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Manufacturer must have twenty (20) years minimum manufacturing experience history in the United States.
   2. Product Quality Assurance Program: Manufacturer shall be an ISO 9001 registered company. A ‘Quality Compliance Certificate (QCC) for reporting/confirming the tested values of the membrane materials will be supplied upon request.
   3. Manufacturer shall have trained technical service representatives employed by the manufacturer, independent of sales.
   4. Manufacturer shall provide site visit reports in a timely manner.

B. Installer Qualifications:
   1. Applicator must be authorized by Manufacturer to install specified materials prior to the bidding period through satisfactory project completion.
   2. Applicator must have completed projects of similar scope using same or similar materials specified.
   3. Applicators shall be skilled in the application methods for all materials.

C. Maintain a daily record, on-site, documenting material installation and related project conditions.

D. Maintain a copy of all submittal documents, on-site, available always for reference.

E. Flashing Substrate Evaluation:
   1. Evaluate substrate moisture content and adhesion of waterproofing materials to substrate throughout the work and record with daily inspection reports or other form of reporting acceptable to the owner or his designated representative and waterproofing manufacturer.
      a. Moisture content: Evaluate substrate moisture content to determine acceptability for application of the specified liquid applied waterproofing materials. Moisture testing shall be performed by means suitable to the project application, or by testing

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substrate relative humidity (RH) in accordance with ASTM F2170 when needed, required, or if substrate moisture content is in question.

b. Adhesion: Evaluate soundness and surface preparation of concrete and/or masonry substrates. Prepare representative areas using specified methods complete with applied primer and waterproofing membrane. Test for minimum acceptable tensile bond strength values as required in accordance with ASTM D4541. Evaluate all areas where concrete appears to differ in appearance or consistency, if multiple areas are involved in the scope of work, evaluate each area with a minimum of (3) tests for every 5,0002 feet (1524060.96 cm) or as required by project conditions.

F. Source Limitations: Furnish products produced by single manufacturer and obtained from single supplier.

1.8 DELIVERY, STORAGE AND HANDLING

A. Refer to each product data sheet or other published literature for specific requirements.

B. Deliver materials and store in unopened, original packaging, bearing Manufacturer's name, related standards, and any other specification or reference accepted as standard.

C. Protect and store materials in dry, well-vented, and weatherproof location. Only materials to be used the same day shall be removed from this location. During cold weather, store materials in heated location, removed only as needed for immediate use.

D. When materials are to be stored outdoors, store away from standing water, stacked on raised pallets or dunnage, at least 4 inch (101.6 mm) or more above ground level. Carefully cover storage with “breathable” tarpaulins to protect materials from precipitation and to prevent exposure to condensation.

E. Carefully store roof membrane materials delivered in rolls on-end with selvage edges up. Store and protect roll storage to prevent damage.

F. Properly dispose of all product wrappers, pallets, cardboard tubes, scrap, waste, and debris. All damaged materials must be removed from job site and replaced with new, suitable materials.

1.9 FIELD CONDITIONS

A. Safety Conditions:
1. Comply with all project-related safety and environmental requirements.
2. Review project conditions and determine when and where conditions are appropriate to utilize the specified liquid applied or semi-solid roofing materials.
3. Review project conditions and determine when and where conditions are appropriate to utilize specified hot asphalt-applied materials.
4. When conditions are determined by the contractor to be unsafe or undesirable to proceed, measures shall be taken to prevent or eliminate the unsafe or undesirable exposures and conditions, or equivalent approved materials and methods shall be utilized to accommodate requirements and conditions.
5. Refer to product Safety Data Sheets (SDS) for health, safety, and environment related hazards, and take all necessary measures and precautions to comply with exposure requirements.

B. Environmental Conditions:
1. Monitor substrate and material temperature, as well as all environmental conditions such as ambient temperature, moisture, sun, cloud cover, wind, humidity, and shade.
2. Ensure conditions are satisfactory to begin work and ensure conditions remain satisfactory during the installation of specified materials.
3. Materials and methods shall be adjusted as necessary to accommodate varying project conditions.
4. Materials shall not be installed when conditions are unacceptable to achieve the specified results.

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5. Precipitation and dew point: Monitor weather to ensure the project environment is dry before, and will remain dry, during the application of roofing materials. Ensure all roofing materials and substrates remain above the dew point temperature as required to prevent condensation and maintain dry conditions.
6. Implement odor control measures where required during the application of waterproofing materials and adjust methods as necessary to accommodate varying project conditions.

1.10 WARRANTY

A. Manufacturer's Waterproofing Warranty providing materials for 10 years from the date the Warranty is issued.

B. Comply with Manufacturer’s requirements as necessary to provide the specified Warranty.

C. Installers’s Warranty covering workmanship for a period of 2 years from completion date.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
   1. SOPREMA, located at: 310 Quadral Drive, Wadsworth, OH 44281; Tel: 800-356-3521; Tel: 330-334-0066; Website: www.soprema.us

2.2 LIQUID APPLIED FLASHING SYSTEM

A. Flashing Membrane:
   1. Polymethyl Methacrylate Flashing Membrane (PMMA):
      a. Monolithic waterproofing flashing membranes:
         1) Basis of Design Product: "ALSAN RS 230 FLASH" Rapid curing, polymethyl methacrylate (PMMA) liquid resin with an embedded polyester reinforcement fabric.
            (a) VOC content: <5 g/L
            (b) Color: White.
            (c) Elongation at 73.4°F (23°C): 55%
            (d) Peak load at 73.4°F lbf/in: 55
            (e) Tear resistance lbf: 70
            (f) Shore A hardness, durometer: 70
            (g) Water absorption at 212°F (100°C): 0.8%
            (h) Water vapor permeance (perms): 0.3
            (i) Low temperature flexibility °F (°C): -33 (-36.1)
            (j) Dimensional stability: 0.1%
      b. Flashing difficult penetrations where a resin/fleece/resin application is not practical:
         1) Basis of Design Product: "ALSAN RS DETAILER" Micro-fiber enhanced, rapid curing, polymethyl methacrylate (PMMA) paste resin.
            (a) VOC content: <10 g/L
            (b) Color: Pebble Grey
   2. Finishing Layer:
      a. Rapid curing, clear polymethyl methacrylate (PMMA) liquid resin used to coat and seal colored silica quartz aggregate.
         1) Basis of Design Products:
            (a) "ALSAN RS 281 CLEAR FINISH"
            (b) "ALSAN TRAFIK RS 781 CL (clear)"
         2) VOC content: 13.4 g/L

3) Color: Clear

b. Rapid curing, polymethyl methacrylate (PMMA) liquid resin combined with SOPREMA ALSAN RS COLOR PACK for custom color surfacing.
   1) Basis of Design Products:
      (a) "ALSAN RS 285 CF (Color Finish)"
         (1) VOC content: 1.4 g/L
         (2) Color: Clear
      (b) "ALSAN RS COLOR ADDITIVE" pouch, Custom color additive.
         (1) VOC content: <5 g/L
         (2) Color: Signal white, Light grey, Pebble grey, Window grey, Stone grey, Beige, Terra cotta, Traffic yellow, Pale Green, Traffic green, Traffic blue, Traffic red, Traffic black, Traffic grey, Custom color.

2.3 ACCESSORIES

A. Primer Basis of Design Products:
   1. "ALSAN RS 276 PRIMER" Rapid curing, polymethyl methacrylate (PMMA) liquid resin used to promote adhesion of PMMA/PMA membranes over wood, concrete and approved waterproofing board substrates.
      a. VOC content: <5 g/L
      b. Color: Clear
   2. "ALSAN RS 222 PRIMER" Rapid curing, polymethyl methacrylate (PMMA) liquid resin used to promote adhesion of PMMA/PMA membranes over asphaltic substrates, wood, concrete and approved waterproofing board substrates.
      a. VOC content: <5 g/L
      b. Color: Clear
   3. "ALSAN RS LO PRIMER" Low odor, two-part, epoxy-based primer for concrete, metals, and other approved substrates.
      a. PART A:
         1) VOC content: 0 g/L
         2) Color: Black
      b. PART B:
         1) VOC content: 0 g/L
         2) Color: Amber
   4. "AQUAFIN Vaportight Coat SG3 Primer" Low odor, two-part, moisture mitigation epoxy-based primer for concrete and approved substrates.
      a. PART A:
         1) VOC content: 0 g/L
         2) Color: Clear
      b. PART B:
         1) VOC content: 0 g/L
         2) Color: Yellowish

B. Catalyst:
   1. Primer Basis of Design Product: "ALSAN RS CATALYST POWDER" Reactive agent used to cure PMMA/PMA liquid resins.

C. Reinforcing Fabric Basis of Design Products:
   1. "ALSAN RS FLEECE" Woven polyester reinforcement used in PMMA/PMA liquid applied membrane and flashing applications.
      a. Thickness: 25 mils 0.03 inch (0.65 mm)
      b. Weights: 110 g/m2
      c. Width(s): 10.3 inch (261.62 mm). Size as required.
      d. Length: 164 feet (4998.72 cm)

2. "ALSAN RS PRE-CUT FLEECE" Factory pre-cut woven polyester reinforcement used for a variety of penetration flashings in PMMA/PMA liquid applied membrane and flashing applications.
   a. Thickness: 25 mils 0.03 inch (0.65 mm)
   b. Weights: 110 g/m2
   c. Component/Size(s): Small Pipe Flashing ½ - 3 inch (76.2 mm), Large Pipe Flashing 4 - 8 inch (203.2 mm), Universal Corner sizes as required.

D. Substrate Patching & Repair:
   1. Polymethyl Methacrylate Paste (PMMA):
      a. Basis of Design Product: "ALSAN RS PASTE" Rapid curing, polymethyl methacrylate (PMMA) paste resin used to fill small cracks and voids on non-traffic bearing substrates prior to the application of PMMA/PMA membranes.
         1) VOC content: 4.4 g/L
         2) Color: Pebble Grey
   2. PolymethOLYMETHACRYLATE MORTAR (PMA):
      a. Basis of Design Product: "ALSAN RS 263 LO MORTAR" Rapid curing, polymethacrylate (PMA) liquid resin used for patching, repairs and leveling, comprised of the following components:
         1) "ALSAN TRAFIK RS 733" PART B: Filler powder.
         2) "ALSAN RS 240 LO" Low odor, rapid curing, polymethacrylate (PMA) liquid resin.
            (a) VOC content: <1 g/L
            (b) Color: Pebble Grey
   3. Polymethyl Methacrylate Mortar (PMMA):
      a. Basis of Design Product: "ALSAN TRAFIK RS 733 SELF-LEVELING MORTAR" Rapid curing, polymethyl methacrylate (PMMA) liquid resin used as a heavy-duty wearing layer in pedestrian and vehicular traffic systems, comprised of the following components:
         1) "ALSAN TRAFIK RS 733" Part A: Rapid curing, polymethyl methacrylate (PMMA) liquid resin.
            (a) VOC content: <5 g/L
            (b) Color: Pebble Grey
         2) "ALSAN TRAFIK RS 733" Part B: Filler powder.

E. Cleaner:
   1. Basis of Design Product: "ALSAN RS CLEANER" Clear, blended solvent used to clean and prepare plastic and metal surfaces and used to clean existing "ALSAN RS" surfaces prior to the application of PMMA/PMA liquid applied membrane and flashings.
      a. VOC content: <5 g/L
      b. Color: Clear

F. Surfacing Aggregate:
   1. Basis of Design Product: "ALSAN RS QUARTZ AGGREGATE" used in PMMA/PMA membranes to provide a slip-resistant and decorative finish to the topcoat.
      a. Grade 0: 0.4-0.03 inch (0.8 mm)
      b. Grade 1: 0.7-0.05 inch (1.2 mm)
      c. Color: Natural, selected from manufacturers available pre-blended or solid colors.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examination includes visual observations, qualitative analysis, and quantitative testing measures as necessary to ensure conditions are satisfactory to begin and remain satisfactory throughout the project.

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B. The contractor shall examine all waterproofing substrates including, but not limited to decks, walls, curbs, equipment, fixtures, and wood blocking.

C. The applicator shall not begin installation until conditions have been properly examined and determined to be clean, dry and, otherwise satisfactory to receive specified roofing and waterproofing materials.

3.2 FLASHING SUBSTRATE PREPARATION

A. Before commencing work each day, the contractor shall prepare all substrates to ensure conditions are satisfactory to proceed with the installation of specified materials.

B. Preparation of substrates includes, but is not limited to, the following:
   1. General:
      a. All substrates must be clean, dry, and free from gross irregularities, loose, unsound, or foreign material such as dirt, ice, snow, water, grease, oil, release agents, lacquers, or any other condition that would be detrimental to adhesion of primer and/or resin materials to the substrate. Most surfaces will require mechanical abrasion in the form of scarifying, shot blasting or grinding to achieve a suitable substrate.
      b. Inspect all substrates and correct defects before application of waterproofing materials. Fill all surface voids 1/16 inch (1.59 mm) or greater wide and/or deep with appropriate fill material.
   2. Concrete Substrates:
      a. Concrete shall comply with requirements of ACI 301 and ACI 308.
      b. Concrete compressive strength: 3,500 psi (24131.66 kPa) for all primers or 2,500 psi (17236.90 kPa) minimum when use of a moisture mitigation primer is required.
      c. Relative humidity: Maximum 75 percent per ASTM F2170 unless otherwise approved.
      d. Surface: Scarify, shot blast or grind to ICRI Concrete Surface Profile CSP 3 to CSP 5; CSP 3 being the preferred profile.
      e. Adhesion: Adhesion of specified primer and structural substrate shall be minimum 220 psi (1516.85 kPa) in traffic bearing waterproofing areas or 116 psi (799.79 kPa) for non-traffic bearing areas per ASTM D4541.
      f. Areas of spalls, voids, bug holes and other deterioration on vertical or horizontal surfaces shall be repaired as required or recommended.
   3. Masonry Substrates:
      a. Walls shall be structurally sound built of hard kiln dried brick, reinforced concrete block, or waterproof concrete block construction.
      b. Liquid applied membrane must not be applied over soft or scaling brick or block, faulty mortar joints, or walls with broken, damaged, or leaking coping. Areas of spalls, voids, bug holes and other deterioration on vertical surfaces shall be repaired as required or recommended.
      c. Walls of ordinary hollow tile or other materials which in themselves are not waterproofed, should not be accepted as suitable to receive liquid applied membrane unless properly waterproofed to prevent moisture infiltration from above or behind the new liquid applied membrane.
      d. Relative humidity: Maximum 75 percent per ASTM F2170 unless otherwise approved.
      e. Surface: Scarify, shot blast or grind to ICRI Concrete Surface Profile CSP 2 to CSP 4.
      f. Adhesion: Adhesion of specified primer and structural substrate shall be minimum 220 psi (1516.85 kPa) for traffic bearing waterproofing applications or 116 psi (799.79 kPa) for roofing or non-traffic bearing waterproofing applications per ASTM D4541.
   4. Metal Substrates:
      a. Clean and prepare metal to near-white metal in accordance with SSPC-SP 3 (power tool clean) to a point maximum 1/8 inch (3.18 mm) beyond the termination of liquid

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applied membrane materials and wipe with solvent cleaner to remove oils, debris, or contaminants.

b. Stainless Steel Series 300 and 400: Abrade to provide rough, open surface and wipe with solvent cleaner to remove oils, debris, or contaminants.

c. Galvanized & Zinc-Rich Metals: Galvanized and/or zinc rich metals are coated with either a layer of oil to prevent white rust or is passivated which must be completely removed prior to applying primer or liquid applied waterproofing. This can be confirmed by applying a coat of copper sulfate solution to the prepared and cleaned galvanized/zinc metal. A properly prepared surface will turn black indicating the passivator has been removed. If the surface does not turn black, additional abrasive cleaning will be required.

5. Rigid Plastics (PVC & ABS):
   a. Rigid plastics should be lightly abraded and wiped with solvent cleaner. Extend preparation maximum 1/8 inch (3.18 mm) beyond the specified termination of the liquid applied membrane flashing materials.
6. Wood Substrates:
   a. Provide sanded ¾ in 0.75 inch (19 mm) minimum thickness APA A-C, Group 1, Exterior or Exposure 1, 48 inch (1219.2 mm) x 96 inch (2438.4 mm) tongue & groove sheathing panels. Install all panels with “A” side up, edges supported by blocking or structural framing, fastened using only non-corrosive screw fasteners with heads installed flush with sheathing applied at 6 inch (152.4 mm) minimum o.c. along panel edges and 12 inch (304.8 mm) o.c. over intermediate supports and/or additional fastening as required by jurisdictional codes. All new plywood substrates shall be structural panels performance-rated pursuant to National Institute of Standards and Technology (NIST) voluntary product standard PS 1-95; identified with American Plywood Association (APA) grade designations.
   b. Hygroscopic building materials such as wood plank, timber or plywood will normally have higher moisture content (in the range of 8% to 12%) as they adsorb or desorb moisture to reach equilibrium moisture content with the surrounding air. Cold liquid applied primer and reinforced membrane should not be applied to damp or wet sheathing materials but may be applied to materials with higher moisture contents as indicated above, provided the exposed surface is clean and dry. Ultimately, determinations of moisture content and the resulting bond strength should be performed periodically to determine acceptability. If poor adhesion or blistering occurs, substrate will require additional drying time before proceeding.
   c. After priming plywood panels, fill joint gaps, holes, and cracks with proprietary PMMA paste or PMMA mortar. All joints must be covered with minimum 1 inch (25.4 mm) wide bond breaker tape followed with minimum 6 inch (152.4 mm) wide strips of cold liquid applied reinforced waterproofing membrane centered over joint. Cover knot holes or cracks with strips of cold liquid applied reinforced waterproofing membrane.
7. Acceptable Rigid Insulation & Roof Cover Boards:
   a. After panels, fill joint gaps, holes, and cracks with proprietary PMMA paste or PMMA mortar. All joints must be covered with minimum 6 inch (152.4 mm) wide strips of cold liquid applied reinforced waterproofing membrane centered over joint.
8. Smooth SBS Modified Bitumen and Asphalt BUR Membrane:
   a. The top surface of existing smooth SBS modified bitumen or Asphalt BUR membrane shall be clean and dry. Remove all dust, dirt, or debris from the surface of the membrane by broom, blower, or power vacuuming.
9. Tie-In to Emulsion Coated or Smooth APP Modified Bitumen Membrane:
   a. The top surface of existing emulsion coated, or smooth APP modified bitumen membrane shall be broadcast to excess with #1 (0.7 - 0.05 inch (1.2 mm) kiln-dried quartz silica. Liquefy the top surface of the in-place membrane using a torch and broadcast silica aggregate into the liquid asphalt to excess. After the asphalt has

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cooled, remove all loose granules, dust, dirt, or debris from the surface of the membrane by broom, blower, or power vacuuming.

10. Tie-In to PVC Single-Ply Membranes:
    a. Remove all contaminants and prepare substrate as needed to receive liquid applied waterproofing.
    b. Lightly scrub PVC membrane with an abrasive pad and wipe with acceptable cleaner.
    c. Adhesion: Examine substrates by conducting adhesion testing. Prime with specified primer where required to achieve adequate adhesion.
11. Tie-In to Other Compatible Flashing Surfaces:
    a. Remove all contaminants and prepare substrate as needed to receive liquid applied waterproofing.
    b. Lightly scrub surface with an abrasive pad and wipe with acceptable cleaner.
    c. Adhesion: Examine substrates by conducting adhesion testing. Prime with specified primer where required to achieve adequate adhesion. If acceptable adhesion is not obtained, attempt higher degree of surface abrasion and repeat.

C. Where conditions are found to be unsatisfactory, work shall not begin until conditions are adjusted appropriately. Commencing of work shall indicate contractor's acceptance of conditions.

3.3 PRIMER APPLICATION (GENERAL)

A. Refer to manufacturer's detail drawings, product data sheets and published general requirements for application rates and specific installation instructions.

B. Examine all substrates and conduct adhesion peel tests as necessary to ensure satisfactory adhesion is achieved.

3.4 PMMA PRIMER APPLICATION

A. Mix primer resin and catalyst approximately 2 minutes using a clean spiral agitator on slow speed or stir stick until evenly mixed. Do not aerate. Mix only the amount of primer that can be used within the application time.

B. Apply the appropriate specified primer to dry, compatible substrates as required to enhance adhesion of new specified waterproofing materials.

C. Apply primer using brush or roller at the rate published on the product data sheet. Do not allow primer to pond or collect in low areas.

D. Project conditions vary throughout the day. Monitor changing conditions, and the curing time of primers.

E. Allow primer to fully cure before membrane application.

3.5 EPOXY PRIMER APPLICATION (SOPREMA ALSAN RS LO PRIMER)

A. Low Odor Primer Applications:
1. Mix A and B parts using a clean spiral agitator on slow speed or stir stick until evenly mixed. Do not aerate. Mix only the amount of primer that can be used within the application time.
2. Apply primer to compatible, clean, and prepared substrate preferably with falling temperature to reduce potential for pinholes from "off-gassing" and as required to enhance adhesion of new specified waterproofing materials.
3. Apply primer using notched squeegee and roller or brush at the rate published on the product data sheet. Do not allow primer to pond or collect in low areas.
4. When primer will be left exposed beyond recommended recoat times, broadcast to excess with #1 (0.7 – 1.2mm) kiln-dried quartz into the final coat of epoxy primer while still wet at the rate of 30 lb as a mechanical bonding layer. After cure, remove loose aggregate and keep dry until subsequent system components are applied.

5. Project conditions vary throughout the day. Monitor changing conditions, and the curing time of primers.
6. Allow primer to fully cure and remove excess aggregate before membrane application.

3.6 EPOXY PRIMER APPLICATION (AQUAFIN VAPORTIGHT COAT SG3 PRIMER)

A. Moisture Mitigation Primer Applications:
1. Mix A and B parts using a clean spiral agitator on slow speed or stir stick until evenly mixed. Do not aerate. Mix only the amount of primer that can be used within the application time.
2. Apply primer to compatible, clean, and prepared substrate preferably with falling temperature to reduce potential for pinholes from “off-gassing” and as required to enhance adhesion of new specified waterproofing materials.
3. Apply primer using a notched squeegee and roller or brush at the rate published on the product data sheet. Do not allow primer to pond or collect in low areas.
4. Allow primer to fully cure and inspect for bubbles, blisters, voids, or pinholes.
5. Repair bubbles, blisters, voids, and pinholes as recommended by manufacturer.
6. For steep slope, vertical and flashing applications, minimum two coats of primer are required.
7. When primer will be left exposed beyond recommended recoat times, following any required primer repairs, apply a second coat of primer over the in-place primer and broadcast to excess with #1 (0.7 – 1.2mm) kiln-dried quartz into the final coat of epoxy primer while still wet at the rate of 30 lb as a mechanical bonding layer. After cure, remove loose aggregate and keep dry until subsequent system components are applied.
8. Project conditions vary throughout the day. Monitor changing conditions, and the curing time of primers.
9. Allow primer to fully cure and remove excess aggregate before membrane application.

3.7 METAL PRIMER APPLICATION

A. Low Odor Primer Applications:
1. Mix A and B parts using a clean spiral agitator on slow speed or stir stick until evenly mixed. Do not aerate. Mix only the amount of primer that can be used within the application time.
2. Apply primer to compatible, clean, and prepared substrate preferably with falling temperature to reduce potential for pinholes from “off-gassing” and as required to enhance adhesion of new specified waterproofing materials.
3. Apply primer using notched squeegee and roller or brush at the rate published on the product data sheet. Do not allow primer to pond or collect in low areas.
4. When primer will be left exposed beyond recommended recoat times, broadcast to excess with #1 (0.7 – 1.2mm) kiln-dried quartz into the final coat of epoxy primer while still wet at the rate of 30 lb as a mechanical bonding layer. After cure, remove loose aggregate and keep dry until subsequent system components are applied.
5. Project conditions vary throughout the day. Monitor changing conditions, and the curing time of primers.
6. Allow primer to fully cure and remove excess aggregate before membrane application.

3.8 SUBSTRATE PATCHING, LEVELING & REPAIR

A. Paste, Self-Leveling Mortar, or Self-Leveling Mortar, General:
1. After priming and before commencing with application of liquid applied waterproofing, the contractor shall patch, level, or repair all substrates as required to eliminate bug holes, voids, cavities, low spots, repair cracks or any other condition that may be detrimental to proper application of the liquid applied waterproofing.

B. Patching, leveling & repairs:

1. Use proprietary paste or resin-mortar for all patching, leveling or repairs wherever possible. Refer to manufacturer's detail drawings, product data sheets and published general requirements for application rates and specific installation instructions.
2. Traffic bearing substrates: Use only resin-mortar for all substrate leveling, patching and repairs.
3. Non-traffic bearing horizontal or vertical substrates: Use paste or resin-mortar for all substrate leveling, patching and repairs.
4. Application:
    a. Install paste or resin-mortar over a fully cured primer.
    b. The substrate shall be dry and free of any dust or loose particles.
    c. Mix paste resin and/or resin-mortar using a slow speed agitator prior to pouring into a larger container.
    d. When required, combine the paste or resin-mortar with #1 (0.7 – 1.2mm) kiln-dried quartz aggregate as recommended for deep voids or large areas.
    e. Mix paste and/or resin-mortar and catalyst approximately 2 minutes using a clean spiral agitator on slow speed or stir stick until evenly mixed. Do not aerate. Mix only the amount of product that can be used within the application time.
    f. Apply the catalyzed paste and/or resin-mortar onto the substrate using a smoothing trowel, working the material into the surface for complete coverage and full adhesion.
    g. Paste and/or resin-mortar should be placed in lifts no greater than the maximum thicknesses recommended.
    h. If additional lifts will be required, broadcast top surface of the placed paste or resin-mortar with clean dry #1 (0.7 - 0.05 inch (1.2 mm) kiln-dried quartz aggregate at approximately 25% coverage while the paste and/or resin-mortar is wet. Place next lift once the paste and/or resin-mortar has cured.

C. Non-moving (Static) Cracks – 0.04 inch (1 mm) or less:
    1. Determine that crack is non-moving. Remove any existing filler and clean out crack by brushing and oil-free compressed air. Fill crack with resin mortar or paste as required.

D. Moving (Dynamic) Cracks – 0.04 inch (1 mm) or less:
    1. Determine that crack is moving. Remove any existing filler and clean out crack by brushing and oil-free compressed air. Fill crack with resin-mortar or paste as required. After the resin-mortar or paste has cured, apply minimum 4 inch (101.6 mm) wide strip of reinforced cold liquid applied membrane centered over crack.

E. Moving (Dynamic) Cracks – 0.12 inch (3 mm) or less:
    1. Determine that crack is moving. Remove any existing filler and clean out crack by brushing and oil-free compressed air. Fill crack with resin-mortar or paste as required. After the resin-mortar or paste has cured, apply bond breaker tape 5 times in width greater than the maximum anticipated expansion. Then cover with a strip of reinforced cold liquid applied membrane centered over crack sized to provided 2 inch (50.8 mm) minimum cover beyond all side of the bond breaker tape but no less than 6 inch (152.4 mm) minimum width.

F. Moving (Dynamic) Cracks – Greater than 0.12 inch (3 mm):
    1. Moving cracks greater than 0.12 inch (3 mm) must be treated as an expansion joint.

3.9 INSTALLATION & STAGING

A. Solvent containing roof mastics, coatings & adhesives:
    1. Do not apply cold liquid-applied PMMA/PMA flashings on, over, or in conjunction with newly applied solvent containing roof mastics, coatings, and adhesives.

B. Follow accepted procedure for applying cold liquid applied membrane flashings to substrate. In all cases the substrate is prepared, primed, and flashings are installed to the in-situ waterproofing membrane. When applying broadcast aggregate, the aggregate should not be

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left subject to the elements and therefore must be top coated with finish the same day of application whenever possible.

C. If work is interrupted for more than 12 hours, use manufacturer's proprietary cleaner to clean and reactivate applied primer, resin mortar, flashing membrane or field membrane transition areas. Cleaner should be allowed a minimum of 20 minutes evaporation time after application and covered within 60 minutes of application or as recommended by the manufacturer.

3.10 FLASHING MEMBRANE APPLICATION

A. General:
1. Refer to manufacturer's detail drawings, product data sheets and published general requirements for application rates and specific installation instructions.
2. Provide a minimum vertical height of 8 inch (203.2 mm) for all flashing terminations wherever possible. Flashing height shall be at least as high as the potential water level that could be reached because of a deluging rain and/or poor slope.
3. Do not flash over existing through-wall flashings, weep holes and overflow scuppers.
4. All flashing shall be terminated as required by the manufacturer. Cap flashings or counter flashings may be constructed of metal, stone, tile, or other materials properly installed in accordance with industry-accepted practice.
5. Install all flashing membranes before installing field membranes.
6. The primed substrate shall be dry and free of any dust, loose particles, or contaminants.
7. Precut reinforcing fleece to conform to terminations, transitions and penetrations being flashed. Ensure a minimum 2 inch (50.8 mm) overlap of fleece at side laps and extend flashing 4 inch (101.6 mm) minimum horizontally onto deck unless otherwise specified. Ensure the completed liquid applied flashing membrane is fully reinforced.
8. Wherever possible factory pre-cut fleece pipe penetration and universal corners shall be used.
9. Mix waterproofing resin and catalyst approximately 2 minutes using a clean spiral agitator on slow speed or stir stick until evenly mixed. Do not aerate. Mix only the amount of waterproofing resin that can be used within the application time.
10. Apply the base coat of catalyzed waterproofing resin onto the substrate using a brush or roller, working the material into the surface for complete coverage and full adhesion.
11. Immediately apply the reinforcing fleece into the wet base coat of resin making sure the smooth side is up. Using a brush or roller, work the reinforcing fabric into the wet resin while applying the second coat of catalyzed waterproofing resin to completely encapsulate the fleece. Avoid any folds and wrinkles.
12. At membrane tie-ins, clean cured membrane with specified cleaner before application of adjacent membrane.

B. Penetrations & Flashings:
1. Pipes, Conduits, Posts, Supports and Unusual Shaped Penetrations:
   a. Pipes, conduits, and other items to be flashed must be separated with ½ in 0.51 inch (13 mm) minimum clearance or as recommended by manufacturer to adequate waterproof each individual penetration.
   b. All penetrations must be flashed individually. Two or more items ganged together in a flashing will NOT be permitted.
   c. Flash penetrations using cold liquid applied reinforced membrane or proprietary fibrated flashing resin as recommended. Flashing shall be applied using factory pre—cut fleece wherever possible consisting of a reinforced deck skirt/target flashing applied over a reinforced vertical wrap finger flashing.
2. Drains:
   a. Flash drains using cold liquid applied membrane. Flashing shall consist of a membrane target extending minimum 12 inch (304.8 mm) horizontally onto the

substrate applied over a finger flashing extended into the prepared drain bowl a minimum of 3 inch (76.2 mm).
b. At no time should the cold liquid applied membrane be installed to restrict or reduce the drain inlet in size.
c. For new drains, contractor shall include cost of all plumbing work, piping, and connection to existing storm sewer system.

3. Hot Pipes:
a. Protect cold liquid applied membrane components from direct contact with steam or heat sources when the in-service temperature exceeds 150□F (65.5□C). In all such cases flash to an intermediate "cool" sleeve.
b. Fabricate "cool" sleeve in the form of a metal cone using non-ferrous metal in accordance with manufacturer details.
c. Flash sleeve using cold liquid applied reinforced membrane like a standard pipe flashing. Flashing shall consist of a reinforced target applied over a reinforced vertical wrap finger flashing.

4. Flexible Penetrations:
a. Provide a weather-tight gooseneck set in manufacturers resin paste and secured to the deck.
b. Flash gooseneck penetrations using cold liquid applied reinforced membrane as recommended. Flashing shall consist of a reinforced target and reinforced vertical wrap finger flashing.

5. Walls, Curbs and Bases:
a. Flash all walls, curbs and bases using cold liquid applied reinforced membrane. Wherever possible extend flashing up and over tops of walls, curbs, and bases so the membrane terminates on the opposite face of the vertical element.

6. Expansion Joints:
a. Flash all expansion joints with minimum two layers of manufacturers cold liquid applied reinforced membrane applied over an expansion joint compressible filler, expansion tube, backer rod and/or bond breaker tape as recommended by manufacturer.

7. Non-standard Flashing Details:
a. When required, consult manufacturer for recommendations on flashing non-standard conditions, penetrations, or protrusions.

C. Thru-Wall Flashings, Mud-set Masonry, & Poured-In-Place Concrete (Bonding/Protection Layer):
1. For all areas to receive new direct applied cement, concrete, or mortar setting bed, apply a supplementary wearing coat of the membrane manufacturer’s cold liquid applied resin.
a. Using a lambswool roller, apply an even layer of cold liquid applied resin at the minimum consumption of 30 lbs or as recommended by the membrane manufacturer and broadcast #1 (0.7 - 1.2mm) kiln-dried quartz aggregate into the wet resin to excess for full coverage.
b. Allow resin bonding layer to cure as recommended by the membrane manufacturer prior to continuing application or applying loads. Remove excess un-adhered aggregate from surface by broom, vacuum, or oil-free blower prior to apply overburden.
c. When required, consult manufacturer for recommendations on flashing non-standard conditions, penetrations, or protrusions.

3.11 WATERPROOFING CONTINUITY TESTING & QC EVALUATION

A. Prior to applying overburden, surfacing or finishes, contractor shall conduct a complete evaluation of the installed waterproofing membrane and liquid applied flashings which shall include visual inspection as well as an acceptable method for (low voltage, high voltage, or water-flood) continuity testing when required.

B. Immediately following evaluation and continuity testing, repair all deficiencies identified in liquid applied waterproofing membrane and flashings.

C. Upon satisfactory completion of all required repairs, proceed with application of all specified overburden, surfacing or finishes.

3.12 FLASHING SURFACING & FINISH (OPTIONAL)

A. General:
1. Where specified or required apply aesthetic surfacing and finish over cured membrane flashings.
2. Refer to manufacturer's detail drawings, product data sheets and published general requirements for application rates and specific installation instructions.
3. Install surfacing and finish layers over fully cured membrane layer.
4. The substrate shall be dry and free of any dust, loose particles, or contaminants.
5. Mix resins using a slow speed agitator prior to pouring into a larger container.
6. Mix surfacing or finish resins with catalyst approximately 2 minutes using a clean spiral agitator on slow speed or stir stick until evenly mixed. Do not aerate. Mix only the amount of product that can be used within the application time.
7. Apply the catalyzed surfacing or finish resin onto the substrate as recommended, working the material into the surface for complete coverage and full adhesion.
8. At tie-ins and previously applied membrane, clean cured surface with specified cleaner before application of subsequent resin materials.

B. Surfacing – Aesthetic color finish:
1. Provide waterproofing manufacturer's proprietary monochromatic color finish resin to create a smooth and readily cleanable surface. This surfacing option is warranted for a period of 1 year from the date of completion. This surfacing option is not recommended where slip-resistant surfaces are required.
2. Surfacing Layer:
   a. Apply an even topcoat of pigmented finish resin using a roller or brush at minimum recommended consumption. Use an appropriate roller to remove excess resin or puddling.

C. Surfacing – Broadcast aggregate finish:
1. Provide waterproofing manufacturer wearing coat and surfacing option using a combination of resin finish and medium-grain aggregate to create a textured wearing surface.
2. Surfacing Layer:
   a. Apply an even topcoat of pigmented or clear finish resin using a roller or brush at minimum recommended consumption.
   b. Broadcast #0 (0.4 - 0.8mm) kiln-dried quartz aggregate into the wet resin to excess for full coverage at an approximate consumption of 100 lb.
   c. Prior to applying finish seal coat, remove excess aggregate from surface by broom, vacuum, or oil-free blower.
3. Finish Seal Coat:
   a. Apply an even seal coat of pigmented or clear resin finish using a roller or brush at minimum recommended consumption.
   b. Finish resin should be applied within 24 hours of the aggregate application over sound, clean, and dry aggregate only.

3.13 CLEAN UP

A. Uncured resin is considered a hazardous material. Unused resin must be catalyzed and cured prior to disposal.

B. Clean up and properly dispose of waste and debris resulting from these operations each day as required to prevent damages and disruptions to operations.

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3.14 PROTECTION

A. Upon completion of new work (including all associated work), institute appropriate procedures for surveillance and protection of finished work during remainder of construction period. Protect all areas where waterproofing membrane has been installed.

END OF SECTION

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SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, materials, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Flashing
   2. Counter-flashing.
   3. Roofing grounds and nailers.
   4. Fabricated sheet metal items for roofing intersections with vertical surfaces.
   5. Copings.
   6. Curbs.
   7. Gutters.
   8. Eaves.,
   9. Roof drains.
   10. Scuppers.
   11. Vents and other roof penetrations.

1.3 REFERENCE STANDARDS

A. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2026.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

C. ASTM A755/A755M - Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products; 2018 (Reapproved 2024).

D. ASTM B32 - Standard Specification for Solder Metal; 2020.

E. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2018).

F. American Society for Testing and Materials (ASTM):

G. National Roofing Contractors Association (NRCA) “Roofing and Waterproofing Manual”
   1. Detail for installation of units.

H. Sheet Metal and Air-Conditioning Contractor’s National Association, Inc. (SMACNA): Architectural Sheet Metal Manual”, latest Edition. Details for fabrication of units, including flanges and installation to coordinate with type of roofing indicated.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements, for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 - Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 – Product Requirements for substitution procedures.

C. Submit Shop Drawings on flashing and sheet metal work.

D. Samples:

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1. Submit 8” 7.99 inch (203 mm) x 8” (203 mm) square samples of each specified sheet materials to be exposed as finished surfaces.
2. Submit each samples of factory fabricated products exposed as finished work, complete with specified factory finish.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements: Ensure flashing and sheet metal complies with requirements of Florida Building Code, NRCA, SMACNA, and ANSI-SPRI/ES-1.

B. Coordinate application of flashings with application of roofing, protruding material, and roof accessories to provide a complete weather tight installation under provisions of the specified warranty requirements.

C. Perform work in accord with referenced standards and manufacturer’s printed installation instructions.

1.7 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. Metal Edge Systems for low-slope roofs shall be selected from manufacturers who certify performance to meet design requirements, based upon testing of such products using the test methodologies RE 1, RE-2, and RE-3 of ANSI/SPRI ES-1 “Wind Design Standard Edge Systems Used with Low Slope Roofing Systems” as required by Florida Building Code Section 1504.5.
   1. Design Pressures: As indicated on the Structural Drawings.
   2. Uplift requirements shall match requirements specified for adjacent membrane roofing.
   3. Wind resistance calculation will be designed specifically for the current project.

D. Gutter Securement for low-slope roofs:
   1. Gutters that are used to secure the perimeter edge of low- slope roof membranes shall be designed, constructed, and installed to resist wind loads indicated and shall be tested in accordance with Test Methods G-1 and G-2 of ANSI/SPRI GT-1.

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change: 120 degrees Fahrenheit (48.89 degrees Celsius), ambient; 180 degrees Fahrenheit (82.22 degrees Celsius), material surfaces.

F. Engineering calculations where indicated to comply with wind uplift requirements.

G. Exterior Product Approvals: Manufacturer shall certify that product complies with large and small missile impact criteria and has been tested and approved in compliance with Florida Product Approval or Miami Dade NOA and applicable requirements.

1.8 PRE-INSTALLATION MEETING

A. Meeting Format:
   1. Pre-installation meeting shall occur after approval of Shop Drawings by Contractor/CM and accepted by AE.
   2. Meeting shall convene minimum of one week before starting work.
   3. Required Attendees:
      a. Contractor/CM.

b. Roof flashings installer.
c. Roofing and roofing equipment manufacturers.
d. Installers of deck or substrate construction to receive roofing work.
e. Installers of roof-top mechanical, plumbing or electrical items or other work in and around roofing that must precede or follow roofing work
f. Other subcontractors associated with work.
g. Architect.
h. Owner’s Project Manager.

4. Contractor/CM shall make arrangements for meeting and notify parties required to attend.
5. Agenda shall include:
   a. Review preparation and installation procedures and coordinating and scheduling required with related work.
   b. Review roof, roof equipment, doors, and window system requirements (drawings, specifications, and other contract documents).
   c. Review Shop Drawings and associated submittals.
   d. Review manufacturer's technical materials.
   e. Review and finalize construction schedule related to work and verify availability of materials, personnel, equipment and facilities needed to make progress and avoid delays
   f. Review required inspection, testing, certifying and material usage accounting procedures.
   g. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions, including temporary roofing.
   h. Meeting may be combined with roofing pre-installation meeting.

1.9 WARRANTIES

A. Provide installer’s five (5) year written warranty for flashings indicated.
   1. Flashings shall resist design wind speeds required by Florida Building Code, Chapter 16, in which installer agrees to repair or replace flashing components of roofing system that fail in materials or workmanship within specified warranty period.
   2. Flashing failures shall include water leaks, fasteners, accessories, flashing and sheet metal, grounds/nailers, gutters and downspouts, scuttles and vents, curbs, and other flashing components of roofing system.

B. See Roofing Specifications for additional warranties that shall also apply.

C. Warranty shall be a term type, with no conditions, exclusions, including exclusions of remedies by Owner, deductibles or limitations on coverage amount. Conditions, exclusions, or dollar limits.

PART 2 PRODUCTS

2.1 MATERIALS

A. Sheet Material:
   1. Type 302 or 304 stainless steel, 22 gage, complying with ASTM A167.
   2. Flashing for Pipes, Conduits, and Round Equipment Supports: Type 304 stainless steel, 26 gage, 2B, complying with ASTM A240.
   3. Solder: Per ASTM B32.

B. Fastening Devices:
   1. Stainless steel fasteners compatible with metal and roofing system. Use of powder-activated fasteners is prohibited.
   2. Attach sheet metal to wood with exposed fastenings: No. 10 x 1-1/4” (31.8mm) pan head stainless steel sheet metal screws. Provide neoprene sealant washers and stainless steel washers under screw heads.

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3. Attachment of sheet metal to masonry or concrete: No. 10 x 1-1/4” (31.8mm) pan head stainless steel masonry screws. Provide neoprene sealant washers and stainless steel washers under screw heads.
4. Roofing Cement: Plastic roofing cement complying with requirements of ASTM D2822 or as appropriate and as recommended by roofing manufacturer.

2.2 ACCESSORIES

A. Roof Drain Flashing: Minimum 4 lb (1.82 Kg) per ft² lead sheet flashing, 36” 3 feet (91.44 cm)
1. x 36” 3 feet (91.44 cm) installed in accord with NRCA specifications.

B. Cants:
1. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
a. Concrecel USA; Product:ARBS (Alternative Roof Blocking System).
2. Pre-fabricated 16-gage, galvanized, minimum 4” 3.98 inch (101 mm) vertical height, formed at 45° angle to walls and parapets.

C. Copings:
1. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
a. SBC Industries, North Miami, Florida.
2. Fabricate in approximately 10 ft. sections using sheet 27-gage aluminum to detail as indicated.
3. Provide continuous aluminum outer hold-down cleat with punched holes at 6” 5.98 inch (152 mm) on center and face fasten at inward facing parapet components with removable fasteners as required for sheet metal per manufacturer’s requirements.
4. Provide 8” 7.99 inch (203 mm) wide joint covers.

D. Curb to Duct Flashing and Counter Flashing:
1. Fabricate from stainless steel to fit duct curbs and ducts projecting from curbs.
2. Provide 4” 3.98 inch (101 mm) vertical flange to cover top edge of bituminous base flashings. Form flange bottom towards curb, with ¼” (0.25 inch (6.3 mm)) bottom edge bent ¼” (6.3 mm) out and hemmed.
3. At top of curbs bend metal 90° and extend horizontally over to duct, then bend upward and extend vertically not less than 3” 2.8 inch (71.2 mm) from top edge of flashing out 3/8” (0.37 inch (9.5 mm)) to receive sealant.
4. Provide for field soldered lap joints at corners and 1” 1 inch (25.4 mm) lap joints at horizontal miter splices.

E. Edge Drips:
1. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
a. Concrecel USA; Product: ARBS (Alternative Roof Blocking System).
2. Fabricate using sheet 22-gage stainless steel drip edge to detail indicated, in not over
a. 10’ 3.28 yard (3 meter) sections.

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3. Provide continuous 16-gage stainless steel continuous cleat with punched holes spaced as necessary. If cleat extends 6” 5.98 inch (152 mm) or more below top fastener, provide second row of punched holes spaced as necessary.
4. Provide 4” 3.98 inch (101 mm) roof flange, and extend bottom drip not less than 1” (1 inch (25.4 mm)) below bottom of roof sheathing, with bottom ¾” (0.75 inch (19 mm)) kick-out to drip water away from finish wall.

F. Pipes, Conduits, Wires, and Round Equipment Supports Penetrating Roofing or Resting on Roofing:
1. Type 304 stainless steel, 26-gage, complying with ASTM A240.
2. Form tubular stainless steel sleeves sized to shape of penetration, not less than 8” 7.95 inch (202 mm) above finished roofing with 4” (3.98 inch (101 mm)) wide base flange welded to water-tight to sleeve.
3. Shop punch flanges.
4. Seal flashing and cover with protective umbrella.
5. Pre-manufactured roof penetration seals:
    a. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
        1) SBC Industries, North Miami, Florida.

G. Sanitary Vent Stack Flashings:
1. 4 lb (1.82 Kg) per ft² lead flashing.
2. Form tubular lead flashing sleeve not less than 8” 7.95 inch (202 mm) high with diameter ½”
    a. (12.7mm) larger than vent stack.
3. Provide 4” 3.98 inch (101 mm) wide flange soldered water-tight.
4. Provide vandal-proof vent covers.

H. Scuppers:
1. Fabricate using 27-gage aluminum to profiles and details shown.
2. Lock seam corners, solder water-tight and hem outer exposed edges.
3. Provide 4” 3.98 inch (101 mm) wide minimum flanges formed to fit cants, decks and vertical wall surface.
4. Shop punch flanges for fastenings at 6” 5.98 inch (152 mm) on center.

I. Gutters:
1. Gutters shall be minimum 6” 5.98 inch (152 mm) wide x 6” (152 mm) deep, 27-gage aluminum with mill finish.
2. Gutter straps shall be 1” 1 inch (25.4 mm) wide rolled aluminum located at 24” o.c. (2 feet (61 cm)) and pop riveted to gutter.
3. Gutter brackets shall be 1.25” wide by 27-gage aluminum with mill finish located at
    a. 2’-6” o.c.
4. Gutters shall be in minimum 10’-0” long sections formed to provide flush exterior seams between gutter sections. Joints between gutter sections shall be 1/2” wide with 6” wide cover plates and support brackets to allow for expansion and contraction. Joints shall be fully bedded in sealant on inside joints.

J. Downspouts:
1. Downspouts:
    a. Downspouts shall be 5” by 5” square 27-gage aluminum with mill finish fabricated in one continuous piece down to kick-out diverter section at bottom of downspout.
    b. Sections shall be welded and ground smooth.

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2. Downspout bracket/straps:
    a. Straps shall be 1” wide by 0.125” thick located not more than 4’-0” apart with top and bottom brackets located not more than 12” from ends of downspouts.
    b. Brackets shall be attached to structure with two .025”diameter Zamac drive pins per bracket.
    c. Bracket shall be attached to gutter with two #10 sheet metal screws each side of bracket and calked with sealant.

K. Stucco Stop with Counter-flashing (2-piece):
1. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
    a. SBC Industries, North Miami, Florida.
2. Fabricate in approximately 10 ft sections using sheet stainless steel to details indicated.
3. Provide receiver with 1.5” wall flange, 0.75” sloping stucco stop, and 0.75” flange
    a. bend downward with 0.50” hem.
4. Shop punch wall flange for fastening.
5. Provide shop fabricated soldered corner splices extending 4” each way.
6. Provide counterflashing with 1.5” 45° top flange with 0.35” kick back at top and 4” bottom flange formed inward ¾” towards wall with hemmed 0.25” kick at bottom.
7. Provide 1.5” x 4” storm cleats.

L. Stucco Top with Counter-flashing (1-piece for re-roofing):
1. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
    a. SBC Industries, North Miami, Florida.
2. Fabricate in approximately 10 feet (304.8 cm) sections using sheet stainless steel to details as indicated.
3. Provide counterflashing with 0.50” 45° leg for sealant with 1.5” wall flange with a 4”
    a. bottom flange formed inward 0.75” towards wall with hemmed 0.50” kick at bottom.
4. Shop punch wall flange for fastening.
5. Provide shop fabricated soldered corner splices extending 4 inches (101.6 mm) each way.

M. Surface Mounted Flashing (1-piece):
1. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
    a. SBC Industries, North Miami, Florida.
2. Fabricate in approximately 10 feet (304.8 cm) sections using sheet stainless steel to detail as indicated.
3. Provide flashing with 1.50” wall flange with 0.25” kick at top to receive sealant, 0.50” 135° sloping top flange and 4” bottom flange formed inward 0.75” towards wall with hemmed 0.50” kick at bottom.
4. Shop punch wall flange for fastening to meet wind loads per FBC
5. Provide shop fabricated corner splices extending 4”.

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PART 3 EXECUTION

3.1 EXAMINATION

A. Do not proceed with work until conditions detrimental to proper and timely completion of work have been corrected in acceptable manner.

3.2 INSTALLATION

A. Lap, rivet, lock, or seal joints, as field conditions require.

B. Provide necessary reinforcement, miscellaneous fittings, and accessories.

C. Apply flashing and sheet metal work including miscellaneous fittings and accessories to even, smooth, sound, thoroughly clean and dry surfaces that are free from defects that might affect application. Prime metal flanges that receive bitumen under provisions of FBC and manufacturer's requirements.

D. Perform soldering work slowly, with properly heated coppers to thoroughly heat seam material and sweat solder through full width of seam that shows no less than 1" of evenly flowed solder. Solder under provisions of ASTM B32.
   1. Start soldering immediately after application of flux.
   2. Solder flat locked seam.

E. Isolate dissimilar metals with accepted isolation paint or other accepted materials.

F. Make flashing and sheet metal work water and weather tight, with lines, arises and angles sharp and true and plane surfaces free from waves and buckles.

G. Provide sufficient fasteners and related hardware to ensure a complete and weather tight system.

H. Base Flashings at Aluminum Walkway Covers Abutting Concrete and Masonry:
   1. Set flashing tight against wall and with roof flange set on aluminum deck in bed of sealant.
   2. Secure roof flanges to metal deck with No. 10 x 0.50" stainless steel sheet metal screws at 6" on center maximum. Provide sealant washers and stainless steel washers under screw heads.

I. Cants Strips: Install at transitions of roof membrane with flat vertical surfaces.

J. Copings:
   1. Secure outer hold-down cleat to woodblock at 6 inches (152.4 mm) on center with ring shank roofing nails.
   2. Install coping over cleat. Allow 0.125" space between each coping section.
   3. Secure inside face of coping with removable grommet type fasteners.
   4. Provide 1" to 12" slope at coping to inner parapet wall.
   5. Install joint covers in full bed of sealant.

K. Curb to Duct Flashing and Counterflashing:
   1. Install flashings after ducts through curbs are in place and after bituminous base flashings are completed.
   2. Place flashings in place on curbs and solder corners and corner miter laps water-tight.
   3. Secure counterflashings to vertical edge of curb nailers with No. 10 stainless steel
      a. sheet metal screws through sealant washers at not over 12" on center.
   4. Secure vertical upturned duct flashing to duct with No. 10 stainless steel sheet metal
      a. screws through sealants washers at not over 6" on center.
   5. Seal joint between flashings and ducts with elastomeric joint sealant.

L. Edge Drips:
   1. Install continuous 20 gage stainless steel cleat.
   2. Set 22 gage stainless steel edge drip roof flanges in full bed of roofing cement over completed roofing.

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3. Lap splices 4” minimum and seal top horizontal surface laps with cold bitumen.
4. Stagger nails at flange to roof deck at 4” on center.
5. Cover roof flanges with 2-ply felt stripping set in full bed of roofing cement.
6. Locate drip bottom not less than 0.75” away from finished vertical surfaces.

M. Roof Drains:
1. Prime roof drain flanges before applying roof felts.
2. Set lead in full bed of cold bitumen over intermediate plies or cap sheet.
3. Strip lead cover with 2 layers of roofing felts in solid coats of hot bitumen.
   a. Roof penetration materials at pipes, conduits and round equipment supports.
   b. After preliminary examination install conical sealant cover with sealant.

N. Sanitary Vent Stack Flashings:
1. Install in accord with NRCA specifications.

O. Scuppers:
1. Set scuppers in full bed of roofing cement over completed base flashing and roof membrane.
2. Secure to masonry walls and concrete decks with stainless sheet metal screws in lead
   a. shields at 6” on center.
3. Secure to wood nailers with stainless steel sheet metal screws at 6” on center.

P. Stucco Stop with Counterflashing (2-piece):
1. Set receiver on masonry and concrete walls where indicated.
2. Lap spices 4 inches (101.6 mm) minimum and seal laps with sealant.
3. Secure to wall with No. 10 x 1.25” minimum Tap-Con screws 12” on center maximum.
4. Check for membrane/bitumen seal on top of felt flashing before counterflashing installation.
5. Attach storm cleats at 30” on center and with 1 cleat at each joint.
6. Insert counterflashing into receiver, and secure tightly with storm cleats.

Q. Surface Mounted Flashing (1-piece):
1. Set on masonry and concrete walls over base flashing where indicated.
2. Lap splices 4” minimum and seal laps with sealant.
3. Secure to wall with No. 10 x 1-1/4 inch (32 mm) Tap-Con pan head screws at 12 inches (304.8 mm) on center maximum. Provide neoprene sealant washers and stainless steel washers.
4. Where corrugated metal wall occurs, place premolded neoprene filler strip on wall immediately above top of metal base flashing.
   a. Set filler strip in sealant and seal abutting edges of filler strip with sealant.
   b. Place counterflashing over filler strip set in sealant and secure flashing to metal wall through filler strip with No. 10 x appropriate length stainless steel sheet metal screws at 6 inches (152.4 mm) on center maximum and centered on wall flutes.
   c. Provide sealant washers and stainless steel washers under screw heads.
5. Check for membrane/bitumen seal on top of felt flashing before flashing installation.

END OF SECTION

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SECTION 07 72 33 - ROOF HATCHES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Roof Hatch
   2. Ladder Safety Post

1.3 REFERENCE STANDARDS

A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

B. ASTM B209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

C. ASTM B210 – Standard Specification for Aluminum-Alloy Drawn Seamless Tubes.

D. ASTM B211 – Standard Specification for Aluminum-Alloy Bar, Rod and Wire.

E. OSHA – Occupational Safety and Health Administration.

F. FM – Roof Assembly Classifications.

G. UL – Fire Hazard Classifications.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements, for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 – Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 – Product Requirements for substitution procedures.

C. Product Data: Provide material descriptions, dimensions of individual components and profiles, and finishes.

D. Shop Drawings: Provide plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

E. Show compliance with OSHA roof fall protection and wind loading requirements. Insure roof ladder installation is provided with unobstructed access and sufficient wall clearance for safe foothold.

F. Exterior Product Approvals: Manufacturer shall submit documentation that product complies with large and small missile impact criteria and has been tested and approved in compliance with Florida Product Approval or Miami Dade NOA and applicable requirements.

1.6 PERFORMANCE REQUIREMENTS

A. Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. Exterior Product Approvals: Manufacturer shall certify that product complies with large and small missile impact criteria and has been tested and approved in compliance with Florida Product Approval or Miami Dade NOA and applicable requirements.

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1.7 PRODUCT HANDLING

A. All materials shall be delivered in manufacturer's original packaging.

B. Store materials in a dry, protected, well-vented area. Inspect product upon receipt and report damaged material to delivering carrier and note such damage on the carrier's freight bill of lading

C. Remove protective wrapping immediately after installation.

1.8 JOB CONDITIONS

A. Coordinate installation with roofing system installation.

1.9 WARRANTY

A. Manufacturer's standard warranty: Materials shall be free of defects in material and workmanship for a period of five (5) years from the date of Substantial Completion. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
   1. Bilco Company: www.bilco.com

B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
   1. Milcor (Hart & Cooley, Inc.)
   2. Babcock-Davis Hatchways, Inc.
   3. Nystrom, Inc.

2.2 MATERIALS AND CONSTRUCTION

A. Basis of Design Product: “S-50”.
   1. Florida NOA: Refer to the “Approved Products” table on drawings for Florida Product Approval and/or NOA numbers.

B. Cover: High strength composite panels with 11-gauge aluminum and with liner bonded to core of 1” conceal fiberglass insulation with an 18-gauge aluminum inner liner. Cover shall open to full 90 degree and offer 70 psf loading.

C. Curb shall be 11-gauge aluminum insulated with 1” fiberboard insulation. Curb shall be 12 inches (304.8 mm) above finished roof surface in height and of integral counterflashing, 3-1/2 inch (89 mm) wide mounting flange with pre-drilled holes.

D. Hatch shall be completely assembled with heavy duty stainless steel hinges, automatic locking hold-open arms, snap latch, inside and outside turn handles, padlock hasp inside, and closed-cell rubber weather seal.

E. Torsion Spring: Cover operation shall be assisted by a torsion spring mounted within the confines of the cover. Springs mounted in frame are unacceptable.

F. Hardware: All hardware shall be zinc or cadmium plated.

G. Hatch Size: 30-inch by 36-inch.

2.3 LADDER SAFETY POST

A. Basis of Design Post: “Ladder Safety Post Model LU-4”.

B. Tubular post shall lock automatically when fully extended and shall have controlled upward and downward movement.

C. Release lever shall disengage the post to allow it to be returned to its lowered position.

D. Post shall have adjustable mounting brackets to fit ladder rung spacing up to 14” on center and clamp brackets to accommodate ladder rungs up to 1-3/4” in diameter.

E. Post: Shall be manufactured of high strength square tubing. A pull up loop shall be provided at the upper end of the post to facilitate raising the post.

F. Material of construction: Shall be aluminum.

G. Balancing Spring: A stainless steel spring balance mechanism shall be provided to provide smooth, easy, controlled operation when raising and lowering the safety post.

H. Hardware: All mounting hardware shall be Type 316 stainless steel.

2.4 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Aluminum: Mill finish unless indicated otherwise.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install hatch in accordance with the manufacturer's printed instructions and with details shown on the Drawings.

B. Provide all items as required for a complete installation in every respect. Failure to include all items will not relieve contractor and manufacturer from specification requirements.

C. Inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

D. Provide attachment and connection devices and methods necessary for securing Work. Secure Work true to line and level. Allow for expansion and building movement.

E. Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.

3.2 ADJUSTMENT AND DEMONSTRATION

A. After installation moving parts shall be properly adjusted to give free, effortless operation. Demonstrate to the Architect that components are fully operable and will perform as intended.

END OF SECTION

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SECTION 07 84 13 - PENETRATION FIRESTOPPING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Penetrations in fire-resistance-rated walls.
   2. Penetrations in horizontal assemblies.
   3. Penetrations in smoke barriers.

1.3 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

B. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2026.

C. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2024.

D. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems; 2024.

E. ASTM E2129 - Standard Practice for Data Collection for Sustainability Assessment of Building Products; Current.

F. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestop Systems; 2024.

G. UL 263 - Standard for Fire Tests of Building Construction and Materials; Current Edition, Including All Revisions.

H. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

I. UL 1479 - Standard for Fire Tests of Penetration Firestops; Current Edition, Including All Revisions.

J. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.

K. FM (Factory Mutual) – Fire Hazard Classifications.

L. UL – Fire Hazard Classifications.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements, for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 - Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 - Product Requirements for substitution procedures.

C. Product Data: For each type of product indicated.

D. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.
   1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-

protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

E. Shop Drawings:
   1. Submit shop drawings showing layout, profiles, and product components.
   2. Include Independent laboratory with system classification number on shop drawings.

F. Provide written documentation of applicator's qualifications, including reference projects of similar scope and complexity, with current phone contacts of references for verification.

G. Certification from sealant manufacturers that their products are suitable for the use indicated and comply with specification requirements.

H. Qualification Data: For Installer.

I. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.

J. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type penetration firestopping.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

B. Use adequate numbers of skilled workers thoroughly trained and experienced in the necessary crafts and completely familiar with the specified requirements and methods needed for proper performance of the work of this section.

C. Applicator Qualifications:
   1. Applicator shall have at least 3-years experience in installing materials of types specified and shall have successfully completed at least 3-projects of similar scope and complexity.
   2. Manufacturer approved applicator.
   3. Applicator shall designate a single individual as project supervisor who shall be on site at all times during installation.

D. Single source responsibility for firestopping materials:
   1. Obtain Firestop materials from single manufacturer for each different product required.
   2. Manufacturer shall instruct applicator in procedures for each material.

E. Regulatory Requirements:
   1. Firestop System installation shall meet requirements of ASTM E814 and provide a fire rating equal to that of the construction it penetrates.
   2. Proposed Firestop materials and methods shall conform to applicable governing codes having local jurisdiction.
   3. For those Firestop applications not having an UL or third party tested system available through any manufacturer.
      a. Prior to installation the manufacturer may submit to the authorities having jurisdiction for their consideration an engineering judgment derived from similar independently tested system of similar design.
      b. Manufacturer's engineering judgment drawings must follow requirements set forth by the International Firestop Council.

1.7 MOCKUP

A. Build mockups to set quality standards for materials and execution at a location selected by the Architect.

B. Apply 3 sq. ft. to a representative substrate surface.

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C. Apply Firestop material to a representative penetrated masonry, concrete, stud wall, and substrate.

D. If Architect determines mockups do not comply with requirements, reconstruct mockups until mockups are approved.

E. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 PRE-INSTALLATION MEETINGS

A. The Contractor shall conduct a pre-installation meeting at the project site a minimum of 30 days prior to any work being installed as indicated in this section and other related sections that require coordination with this section.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

C. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.

D. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.

1.10 SYSTEM DESCRIPTION

A. General: Provide firestopping systems that are produced and installed to resist the spread of fire, according to requirements indicated, and the passage of smoke and other gases.

B. F-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with F ratings indicated as determined per ASTM E814, UL 1479 but not less than that equaling or exceeding the fire resistance rating of the constructions penetrated.

C. T-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with T ratings, in addition to F ratings, as determined per ASTM E814, where indicated and where systems protect penetrating items exposed to contact with adjacent materials in occupiable floor areas. T-rated assemblies are required where specified by codes or where the following conditions exist:
   1. Where firestop systems protect penetrations located outside of wall cavities.
   2. Where firestop systems protect penetrations located outside fire resistive shaft enclosures.
   3. Where firestop systems protect penetrations located in construction containing doors required to have a temperature rise rating.
   4. Where firestop systems protect penetrating items larger than a 4 inch (101.6 mm) diameter nominal pipe or 16 sq inch (42281205.76 sq mm) in overall cross sectional area.

D. Fire Resistive Joint Sealants: Provide joint sealants with fire resistance ratings indicated, as determined per ASTM E119, UL 1479 and UL 2079 but not less than that equaling or exceeding the fire resistance rating of the construction in which the joint occurs.

E. For firestopping exposed to traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions and will meet load requirements.
   1. For piping penetrations for plumbing and wet pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
   2. For floor penetrations with annular spaces exceeding 4 inches (101.6 mm) in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved either by installing floor plates or by other means.

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3. For penetrations involving insulated piping, provide through-penetration firestop systems not required removal of insulation.

F. For through-penetration firestop systems exposed to view, provide products with flame spread of less than 25 and smoke developed ratings of less than 450, as determined per ASTM E84.

G. Firestopping Materials: ASTM E119, ASTM E814, UL 263 or UL 1479 to achieve fire rating.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
   1. Specified Technologies Inc.
   2. Hilti, Inc.
   3. 3M Fire Protection Products.
   4. Tremco, Inc.; Tremco Fire Protection Systems Group.
   5. USG Corporation.

2.2 FIRESTOPPING, GENERAL

A. Compatibility: Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by firestopping manufacturer based on testing and field experience.
   1. All materials shall comply with ASTM E814 or E119 (UL 1429), and shall be manufactured of nontoxic, non-hazardous, asbestos free materials, and unaffected by water or moisture when cured.
   2. Primers: Conform to manufacturer’s recommendations for primers required for various substrates and conditions.
   3. Backup Materials: Backup materials, supports, and anchoring devices shall be provided as required by UL testing.

B. Accessories: Provide components for each firestopping system that are needed to install fill materials and to comply with "System Performance Requirements" in Part 1. Use only components specified by the firestopping manufacturer and approved by the qualified testing and inspecting agency for the designated fire resistance rated systems. Accessories include but are not limited to the following items:
   1. Permanent forming/damming/backing materials must be noncombustible and may include the following:
      a. Semi-refractory fiber (mineral wool) insulation.
      b. Sealants used in combination with other forming/damming materials to prevent leakage of fill materials in liquid state.
      c. Joint fillers for joint sealants.
   2. Temporary forming materials.
   3. Substrate primers.
   4. Collars.
   5. Steel sleeves.

C. Use only firestopping products that have been UL 1479 or ASTM E814 tested for specific fire rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire rating involved for each separate instance.

2.3 PENETRATION FIRESTOPPING

A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
   1. Fire-resistance-rated walls include fire walls fire-barrier walls smoke-barrier walls and fire partitions.
   2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
   1. Horizontal assemblies include floors floor/ceiling assemblies and ceiling membranes of roof/ceiling assemblies.
   2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
   3. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.
   1. L-Rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening at 0.30-inch wg (74.7 Pa) at both ambient and elevated temperatures.

E. W-Rating: Provide penetration firestopping showing no evidence of water leakage when tested according to UL 1479.

F. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E84.

2.4 ACCESSORIES

A. Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.
   1. Permanent forming/damming/backing materials, including the following:
      a. Slag-wool-fiber or rock-wool-fiber insulation.
      b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
      c. Fire-rated form board.
      d. Fillers for sealants.
   2. Temporary forming materials.
   3. Substrate primers.
   4. Collars.
   5. Steel sleeves.

B. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces.

C. Installation Accessories: Clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

D. Intumescent fiberglass bags for sealing cable tray openings.

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E. Surface Sealer: Single-component, silicone sealant flexible firestop. Provide at joints over mineral wool filler and as indicated.
   1. Manufacturers: The basis of design product “Fire Barrier 100NS” manufactured by 3M. Equal or better performing products of other manufacturers will be considered for acceptance by the Architect.

2.5 MIXING

A. For those products requiring mixing before application, comply with penetration firestopping manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

2.6 ENVIRONMENTAL

A. Data: Submit manufacturer’s product data for sealants. Indicate VOC limits of the product. Submit MSDS highlighting VOC limits in accordance with Table 1 of ASTM E2129 for products provided under work of this Section.

B. Certification: Submit manufacturer’s certification that products comply with Bay Area Resources Board, reg. 8, rule 51.

C. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Part 59, Subpart D (EPA Method 24):
   1. Architectural Sealants: 250 g/L.
   2. Sealant Primers for Nonporous Substrates: 250 g/L.
   3. Sealant Primers for Porous Substrates: 775 g/L.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:
   1. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
   2. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

3.3 INSTALLATION

A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
   1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.

C. Install fill materials for firestopping by proven techniques to produce the following results:
   1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
   2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
   3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (152.4 mm) of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
   1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage".
   2. Contractor's name, address, and phone number.
   3. Designation of applicable testing and inspecting agency.
   4. Date of installation.
   5. Manufacturer's name.
   6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Inspecting Agency: Construction Manager will engage a qualified testing agency to perform tests and inspections of penetration firestopping systems according to ASTM E2174, Standard Practice for On-Site Inspection of Installed Fire Stops.

B. Where deficiencies are found or penetration firestopping systems are damaged or removed due to testing, repair or replace penetration firestopping systems so they comply with requirements.

C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

END OF SECTION

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SECTION 07 91 00 - PREFORMED JOINT SEALS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, materials, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Precompressed foam seals.

1.3 REFERENCE STANDARDS

A. ASTM D2628 - Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements; 2025.

B. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements, for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 - Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 - Product Requirements for substitution procedures.

C. Product Data: Manufacturer's technical data sheets for each product, including chemical composition, movement capability, color availability, limitations on application, and installation instructions.

D. Color Cards: For color selection.

E. Manufacturer's Qualification Statement.

F. Installer's Qualification Statement.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified in this section with at least three years of documented experience.

1.7 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Correct defective work within a two year period after Date of Substantial Completion.

C. Warranty: Include coverage for installed sealers that fail to achieve watertight seal or exhibit loss of adhesion or cohesion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with

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Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.

1. Nystrom, Inc: www.nystrom.com

2.2 PRECOMPRESSED FOAM SEALS

A. Precompressed Foam Seal: Comprised of urethane, modified-acrylic impregnated, open-cell polyurethane, or closed-cell neoprene foam impregnated with water-repellent, and with self-adhesive faces protected prior to installation by release paper.
   1. Color: Black.
   2. Size as required to provide weathertight seal when installed.
   3. Calculate size according to manufacturer's recommendations.
   4. Measure size of existing joints before selecting seal width.
   5. Fire-Rating: As indicated on drawings, comply with UL 2079.
   6. Provide product recommended by manufacturer for traffic-bearing use.

B. Precompressed Foam Seal, Fire-Retardant Impregnated: Comprised of waterproof silicone face on fire-retardant impregnated foam seal.

C. Compressible, Sound- and Fire-Resistant Foam Seal: Comprised of factory coated, colored silicone face on one side of fire-resistant, acrylic impregnated polyurethane foam seal.

2.3 ACCESSORIES

A. Adhesive: As recommended by seal manufacturer.

B. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and strip seal.

C. Substrate Cleaner: Non-corrosive, non-staining type recommended by seal manufacturer; compatible with joint forming materials.

D. Primer: Type recommended by seal manufacturer to suit application; non-staining.

E. Backing Tape: Self-adhesive polyethylene tape with surface that seal will not adhere to.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that joints are ready to receive this work.

B. Measure joint dimensions and verify that seal products are of the correct size to properly seal the joints.

3.2 PREPARATION

A. Properly prepare construction components adjacent to the work of this section to prevent damage and disfigurement due to this work.

3.3 INSTALLATION

A. Install in accordance with manufacturer's written instructions.

B. Precompressed Foam Seals:
   1. Install only when ambient temperature is within recommended application temperature range of adhesive. Consult manufacturer when installing outside this temperature range.
   2. Prepare joints and install seals in accordance with manufacturer's written recommendations.
   3. Remove loose materials and foreign matter that could impair adhesion of sealant.
   4. Do not stretch precompressed seal; avoid joints except at corners, ends, and intersections; install with face 1/8 to 1/4 inch (3 to 6 mm) below adjoining surface.

3.4 CLEANING

A. Clean adjacent soiled surfaces.

3.5 PROTECTION

A. Protect joints from damage until adhesives have properly cured.

END OF SECTION

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SECTION 07 92 00 - JOINT SEALANTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Exterior and interior sealants.
   2. Spray foam sealant.

1.3 REFERENCE STANDARDS

A. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants; 2018 (Reapproved 2022).

B. ASTM C834 - Standard Specification for Latex Sealants; 2017 (Reapproved 2023).

C. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2024.

D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).

E. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008 (Reapproved 2023).

F. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2025.

G. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2022.

H. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2023.

I. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints; 2019 (Reapproved 2025).

J. ASTM D1056 - Standard Specification for Flexible Cellular Materials—Sponge or Expanded Rubber; 2020.

K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

L. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.

M. ASTM E2129 - Standard Practice for Data Collection for Sustainability Assessment of Building Products; Current.

N. ACI 504 R – Guide to Joint Sealants for Concrete Structures.

O. SWRI (Sealant, Waterproofing and Restoration Institute) – Sealant and Caulking Guide Specification.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements, for code requirements and code standards applicable to all materials and work necessary to complete the scope of work

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 - Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 - Product Requirements for substitution procedures.

C. Product Data: For each joint-sealant product.

D. Samples: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

E. Qualification Data: For qualified testing agency.

F. Product Test Reports: For each kind of joint sealant, for tests performed by manufacturer.

G. Certificates from the manufacturers of joint sealants attesting that their products comply with the specification and are suitable for the use indicated.

H. Submit environmental data in accordance with Table 1 of ASTM E2129 for products provided under work of this section.

I. Preconstruction Laboratory Test Schedule: Include the following information for each joint sealant and substrate material to be tested:
   1. Joint-sealant location and designation.
   2. Manufacturer and product name.
   3. Type of substrate material.
   4. Proposed test.
   5. Number of samples required.

J. Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in within.

K. Field-Adhesion-Test Reports: For each sealant application tested.

L. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed joint sealant applications similar in material, design, and extent to that indicated for Project that have resulted in construction with a record of successful in-service performance.
   1. Shall be a sealant and caulking subcontractor with a minimum of five (5) years of successful experience in the application of the types of materials required, and who agrees to employ only skilled tradesmen for the Work.

B. Product Testing: Test joint sealants using a qualified testing agency.
   1. Testing Agency Qualifications: Qualified according to ASTM C1021 to conduct the testing indicated.

1.7 PERFORMANCE REQUIREMENTS

A. Surface Hardness: Provide types of sealant to withstand anticipated abrasive or possible indentation as recommended by manufacturer.

B. Compatibility: Provide materials that are compatible with the joint surfaces, joint fillers, and other materials in the joint system.

C. Provide joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates will not sag, and will resist thermally induced movement, and exposure to weather without failure.

D. Provide acoustical joint sealants at all walls that are STC rated or where sound attenuation blankets are used.

1.8 PRE-INSTALLATION MEETING

A. The Contractor shall conduct a pre-installation meeting at the project site a minimum of 30 days prior to any work being installed as indicated in this section and other related sections that require coordination with this section.

1.9 MOCK-UPS

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A. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this section. Use materials and installation methods specified in this section.

1.10 PRECONSTRUCTION TESTING

A. Product Testing: Test joint sealants using a qualified testing agency.
   1. Testing Agency Qualifications: Qualified according to ASTM C1021 to conduct the testing indicated.

B. Preconstruction Capability and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
   1. Adhesion Testing: Use ASTM C794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
   2. Stain Testing: Use ASTM C1248 to determine stain potential of sealant when in contact with stone or masonry substrates.
   3. Submit manufacturer's recommended number of pieces of each type of material, including joint substrates, joint-sealant backings, and miscellaneous materials.
   4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
   5. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.
   6. Testing will not be required if joint-sealant manufacturers submit data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, staining of, and compatibility with joint substrates and other materials matching those submitted.

C. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
   1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
   2. Conduct field tests for each kind of sealant and joint substrate.
   3. Notify Architect seven days in advance of dates and times when test joints will be erected.
   4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
      a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
         1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
   5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
   6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.
   7. Field testing as recommended by sealant manufacturer.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.

B. Store and handle materials in compliance with manufacturer’s requirements to prevent their deterioration or damage due to moisture, temperature, contaminants, or other causes.

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1.12 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
   2. When joint substrates are wet.
   3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
   4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.13 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this section within specified warranty period of Five (5) years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Caulking Compounds (Acrylic Latex Sealant)
   1. Latex rubber modified, acrylic emulsion polymer sealant compound; manufacturer’s standard, one-part, non-sag, mildew resistant, acrylic emulsion sealant complying with ASTM C834, formulated for accepting paint. (Product recommended for exposed interior locations involving joint movement of less than 5%).
   2. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
      a. “Sonolac”; Sonneborn Building Products, Inc.
      b. “Acrylic Latex Caulk 832”; Tremco, Inc.
      c. “Acrylic Latex Caulk with Silicone”; DAP
      d. “Powerhouse Siliconized Acrylic Latex Sealant”; Sherwin-Williams

C. One-Part Elastomeric Sealant (Silicone)
   1. One component elastomeric sealant complying with ASTM C920, Class 25, Type NS (non-sag), unless manufacturer recommends Type S (self-leveling) for the application shown. (general caulking, glazing applications).
      a. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
         1) “Dow Corning 791; Dow Corning Corp.
         2) “Omniseal”; Sonneborn Building Products, Inc.
         3) “Spectrem 2; Tremco, Inc.
         4) “MAXFLEX Acrylic Urethane Elastomeric Sealant”; Sherwin-Williams

D. One component mildew resistant silicone sealant used around countertops, backsplashes, and other wet interior locations.

1. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
   a. “Dow Corning 786”, Dow Corning Corp.
   b. “Sanitary 1700”; General Electric
   c. “White Lightning Silicone K&B Sealant”; Sherwin-Williams
2. One-component high movement joints (+100/-50) use sealants in locations indicating high movement.
   a. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
      1) “Dow Corning 790”; Dow Corning Corp.
      2) “Spectrem 1”; Tremco, Inc.
      3) “LOXON H1 Hybryd”; Sherwin-Williams

E. Elastomeric Sealants (Polyurethane)
1. One component polyurethane sealant, complying with ASTM C920, Type S, Grade NS (non-sag), Class 25 (masonry expansion and control joints, perimeter caulking, flashing and sheet metal conditions).
   a. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
      1) “Sonolastic NP 1”; Sonneborn Building Products, Inc.
      2) “Dymonic”: Tremco, Inc.
      3) “Dynatrol I”; Pecora Corp.
      4) “LOXON S1”; Sherwin-Williams
2. Multi-component epoxidized polyurethane sealant complying with ASTM C920, Type M, Grade NS, Class A (same uses as described in item 1, also used on fire resistance rated joint design details.)
   a. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
      1) “Dymeric”; Tremco, Inc.
      2) “DynaTrol II”; Pecora Corp.

F. One-part self-leveling polyurethane sealant (for traffic areas)
1. One component polyurethane self-leveling sealant, complying with ASTM C920, Type S, Grade P, Class 25.
   a. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding

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substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
1) "Sonolastic SL 1"; Sonneborn Building Products, Inc.
2) "NR-201 Urexpan"; Pecora Corp.
3) "LOXON SL1"; Sherwin-Williams

G. Spray Foam (Joint between top of interior smoke walls and exterior walls with the metal deck or structure above and as indicated elsewhere).
1. Low pressure two-component polyurethane expanding spray foam.
a. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
1) DAP Products Inc.
(a) Basis of Design Product: "Touch n Foam Professional – All Purpose Spray Foam".
b. Rating: Class A fire resistance

2.2 ACOUSTICAL JOINT SEALANTS

A. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, non-staining latex sealant complying with ASTM C834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E90.
1. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
a. Sherwin Williams "Powerhouse Siliconized Acrylic Latex Sealant"
b. Pecora Corporation "AC-20 FTR"
c. USG Corporation "SHEETROCK Acoustical Sealant"

B. Product is effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies per ASTM E90.

C. Product has flame spread and smoke developed ratings of less than 25 per ASTM E84.

D. Acoustical Sealant for Concealed Joints: Manufacturer's standard, nondrying, non-hardening, non-skinning, non-staining, gunnable, synthetic rubber sealant recommended for sealing interior concealed joints to reduce transmission of airborne sound.

2.3 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin) and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance. Provide polyethylene, butyl neoprene or other material that will not bond to sealant., 20 to 25 percent larger in diameter than joint width, unless recommended otherwise by the sealant manufacturer.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.4 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

2.5 COLORS

A. Colors: Select colors from standards manufacturer’s color charts.

B. Special Colors: Hollow metal door frames at the floor joint shall have caulking color that matches the hollow metal frame color.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint sealant performance. Do not proceed with installation of joint sealants until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with recommendations of joint sealant manufacturer and the following requirements:
   1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
   2. Clean concrete, masonry, unglazed surfaces of ceramic tile, and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
   3. Remove laitance and form release agents from concrete.
   4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile, and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealant manufacturer based on preconstruction joint sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's recommendations. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 SELECTION OF MATERIAL

A. Caulking compounds shall be used for interior nonmoving joints and at locations specifically indicated on Drawings.

B. One component elastomeric silicone sealants shall be used at all exterior joints and interior joints where thermal or dynamic movement is anticipated.

C. One component elastomeric polyurethane sealants shall be used at interior joints where weatherproofing is required.

D. One-part self-leveling polyurethane sealants shall be used for exterior and interior horizontal joints subject primarily to pedestrian traffic and light and moderated vehicular traffic, and in all control joints in slab-on-grade; interior.

E. Acoustical joint sealants shall be used at all walls that are STC rated or where sound attenuation blankets are used.

3.4 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint sealant manufacturer's printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.
   1. Joints to be filled shall be thoroughly dry and free from dust, dirt, oil, and grease at the time of application or caulks or sealants.
   2. Expansion and control joints in exterior walls shall have the joint filler material built into the wall, or between wall and slab, at the time of construction.
   3. Masking: Metal shall be masked with masking tape, as well as other surfaces where its required to prevent the sealant smearing the adjacent surface. Upon completion of the caulking, remove the tape.
   4. Sealants shall be integral color. Painting of sealants is not allowed.

B. Sealant Installation Standard: Comply with recommendations of ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated. Provide concave joint.

C. Acoustical Sealant Application Standard: Comply with recommendations of ASTM C919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

D. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:
   1. Install joint fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
      a. Do not leave gaps between ends of joint fillers.
      b. Do not stretch, twist, puncture, or tear joint fillers.
      c. Remove absorbent joint fillers that have become wet prior to sealant application and replace with dry material.
      d. Provide backer material in sealed joints at a depth that will permit application of sealant in an hourglass profile with a depth 1/2 the joint width, but in no case less than 1/2".

E. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.

F. Tooling of Non-sag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

G. Sealant Locations:

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1. Install in exterior joints in vertical surfaces and non-traffic horizontal surfaces as indicated below:
   a. Joints between different materials.
   b. Perimeter joints between materials and frames of doors, windows, and louvers.
   c. Control and expansion joints in ceiling and overhead surfaces.
   d. Other joints as indicated or required.
2. Install in exterior joints in horizontal traffic surfaces as indicated below:
   a. Control, expansion, and isolation joints in cast-in-place concrete slabs.
   b. Joints between different materials listed above.
   c. Other joints as indicated or required.
3. Install in interior joints in vertical surfaces and horizontal non-traffic surfaces as indicated below:
   a. Perimeter joints of exterior openings where indicated.
   b. Joints between tops of non-load-bearing unit masonry walls and underside of cast-in-place concrete slabs and beams.
   c. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
   d. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
   e. Perimeter joints of toilet fixtures and accessories.
   f. Other joints as indicated or required.
4. Install in interior joints in horizontal traffic surfaces as indicated below:
   a. Control and expansion joints in cast-in-place concrete slabs.
   b. Other joints as indicated or required.

3.5 SPRAY FOAM INSTALLATION

A. Verify that substrates are clean, dry, and free of substances that are harmful to insulation.

B. Comply with insulation manufacturer's written instructions applicable to products and applications.

C. Spray insulation to envelop entire void area to produce a complete air barrier.

3.6 CLEANING AND PROTECTION

A. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

B. Protect joint sealants during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so that and installations with repaired areas are indistinguishable from original work.

3.7 GENERAL INSTALLATION PROVISIONS

A. Inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

B. Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.

C. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.

D. Visual Effects: Provide uniform joint widths in exposed Work. Arrange joints in exposed Work to obtain the best visual effect. Refer questionable choices to the Architect for final decision.

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E. Recheck measurements and dimensions, before starting each installation.

F. Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.

3.8 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
   1. Extent of Testing: Test completed and cured sealant joints (not on mockup) as follows:
      a. Perform five tests for the first 1000 feet (30480 cm) of joint length for each kind of sealant and joint substrate.
      b. Perform one test for each 1000 feet (30480 cm) of joint length thereafter or one test per each floor per elevation.
      c. Perform three per elevation.
   2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
      a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
   3. Inspect tested joints and report on the following:
      a. Whether sealants filled joint cavities and are free of voids.
      b. Whether sealant dimensions and configurations comply with specified requirements.
      c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
   4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
   5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

END OF SECTION

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Steel Doors.
   2. Steel Frames.
   3. Refinishing existing metal doors and frames.

1.3 REFERENCE STANDARDS

A. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems; 2015.

B. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames; 2024.

C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2023.

D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2025.

E. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

F. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

G. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

H. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

I. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

J. ASTM A568/A568M - Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for; 2025a.

K. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

L. ASTM A879/A879M - Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface; 2022.

M. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.

N. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2025.

O. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2020.

P. ASTM C476 - Standard Specification for Grout for Masonry; 2023.

Q. ASTM C764 - Standard Specification for Mineral Fiber Loose-Fill Thermal Insulation; 2025.

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R. ASTM C1363 - Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus; 2024.

S. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

T. ASTM E413 - Classification for Rating Sound Insulation; 2022.

U. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2025.

V. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.

W. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

X. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

Y. ANSI A117.1 – Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.

Z. ASTM A591/A591M-98 – Standard Specification for Steel Sheet, Electrolytic Zinc-Coated, for Light Coating Weight Mass Applications.

AA. ASTM E2074 – Standard Methods of Fire Tests of Door Assemblies, Including Positive Pressure Testing of Side-Hinged and Pivoted Swinging Door Assemblies.

BB. DHI (Door Hardware Institute) – The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builder's Hardware.

CC. SDI-100 – Standard Steel Doors and Frames.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements, for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 – Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 – Product Requirements for substitution procedures

C. Product Data: Details of construction, materials, dimensions, hardware preparation, core, label compliance, sound ratings, profiles, and finishes.

D. Shop Drawings: Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of door and frame hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items.
   1. Provide schedule of doors and frames using same reference numbers for details and openings as those on Contract Drawings.
   2. Indicate coordination of glazing frames and stops with glass and glazing requirements.
   3. Shop drawings for exterior door assemblies shall be signed and sealed by a licensed engineer registered in the State of Florida.
   4. Calculations for wind load design for exterior door assemblies shall be stamped, sealed, and signed by a Professional Engineer in the State of Florida verifying compliance with ASCE/SEI 7-02.

E. Label Construction Certification: For door assemblies required to be fire-rated and exceeding limitations of labeled assemblies, submit manufacturer's certification that each door and frame assembly has been constructed to conform to design, materials, and construction equivalent to requirements for labeled construction.

F. Obtain approval of shop drawings prior to proceeding with manufacturing.

G. Closeout Submittals: Provide inventory of doors, frames, and hardware in an exportable (i.e. Excel).

H. Samples:
   1. If requested by the Architect, submit a 18” X 24” cut-away sample door with provisions for lockset, hinge and corner section of frame.
      a. Construct door sample to show vertical edge construction, top and bottom construction, insulation, face stiffeners, hinge, and other applied hardware reinforcements. Include louver sections and glazing stop where applicable.
      b. Construct frame sample to show frame profile, welded corner joint, welded hinge reinforcement, dust cover boxes, floor anchors and wall anchors. Include panel and louver sections and glazing stops where applicable.

I. Submit test reports upon request by the Owner or Architect.

J. Exterior Product Approvals: Manufacturer shall submit documentation that product complies with large and small missile impact criteria and has been tested and approved in compliance with Florida Product Approval or Miami Dade NOA and applicable requirements.

1.6 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Employ only manufacturers who make the specified products as a regular production item.

B. Contractor Qualifications: Employ only experienced Contractors (Installers) skilled in the successful installation of specified materials and assemblies on similar projects for not less than five (5) years.

C. Provide doors and frames complying with Steel Door Institute "Recommended Specifications Standard Steel Doors and Frames" ANSI/SDI-100 and as herein specified.

D. Fire-Rated Door Assemblies: Units that comply with NFPA 80, are identical to door and frame assemblies whose fire resistance characteristics have been determined per ASTM E2074 and which are labeled and listed by UL, Factory Mutual, Warnock Hersey, or other testing and inspecting organization acceptable to authorities having jurisdiction.
   1. Label fire doors and frames listed in accordance with Underwriters Laboratories standard UL 10C, and Positive Pressure Fire Tests of Door Assemblies.
   2. Construct and install doors and frames to comply with applicable issue of ANSI/NFPA 80.
   3. Manufacture Underwriters' Laboratories labeled doors and frames under the UL factory inspection program and in strict compliance to UL procedures, and provide the degree of fire protection, heat transmission and panic loading capability indicated by the opening class.
   4. Manufacture Intertek Testing Services / Warnock Hersey labeled doors and frames under the ITS/WH factory inspection program and in strict compliance to ITS/WH procedures, and provide the degree of fire protection capability indicated by the opening class.
   5. Affixed physical label or approved marking to fire doors and/or fire door frames, at an authorized facility as evidence of compliance with procedures of the labeling agency. Labels to be metal, paper or plastic. Stamped or die cast labels are not permitted. Labels are not to be removed, defaced or made illegible while the door is in service as covered in NFPA 80.
   6. Fire door assemblies in exit enclosures and exit passageways: Maximum transmitted temperature end point of not more than 450°F (121°C) above ambient at the end of 30 minutes of the standard fire test exposure.
   7. Conform to applicable codes for fire ratings. It is the intent of this specification that hardware and its application comply or exceed the standards for labeled openings. In case of conflict between types required for fire protection, furnish type required by NFPA and UL.

E. Hollow metal supplier shall be a qualified direct distributor of products to be furnished. In addition, the distributor shall have in their regular employment an Architectural Hardware

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Consultant (AHC) or a Certified Door Consultant (CDC), who will be available at reasonable times to consult with the Architect regarding matters affecting the door and frame openings.

F. Exterior doors and frames:
   1. Installations shall be weather tight and leak proof.
   2. Hurricane Doors: Door systems required to comply with the Miami-Dade County Product Control Approval System or the Florida Building Code Approval System meeting the requirements of Miami-Dade County test protocols PA 201, PA 202, PA 203 and Florida Building Code test protocols TAS 201, TAS 202 and TAS 203.
   3. Exterior Product Approvals: Manufacturer shall certify that product complies with large and small missile impact criteria and has been tested and approved in compliance with Florida Product Approval or Miami Dade NOA and applicable requirements.

1.7 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide door and frame assemblies capable of withstanding wind pressures calculated according to the following:
   1. Basic Wind Speed:
      a. Comply with the Florida Building Code with the applicable Supplement and as indicated on the structural drawings.
   2. Importance Factor:
      a. Comply with the Florida Building Code with the applicable Supplement and as indicated on the structural drawings.

B. Exterior Product Approvals: Manufacturer shall certify that product complies with large and small missile impact criteria and has been tested and approved in compliance with Florida Product Approval or Miami Dade NOA and applicable requirements.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish.

B. Inspect doors and frames upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new Work and acceptable to Architect; otherwise, remove and replace damaged items as directed.

C. Storage of Doors:
   1. Store doors vertically in a dry area, under proper cover. Place the units on at least 4" high wood sills on floors in a manner that will prevent rust and damage.
   2. Avoid storage in non-vented plastic or canvas shelters, which create a humidity chamber and promote rusting. If the door becomes wet, or moisture appears, remove protective wrapping immediately.
   3. Provide a 4" space between the doors to permit air circulation. Proper storage is required to meet the requirements of ANSI/SDI A250.10 and HMMA 840.

D. Storage of Frames:
   1. Store frames in an upright position with heads uppermost under cover on 4" wood sills on floors in a manner that will prevent rust and damage.
   2. Do not use non-vented plastic or canvas shelters, which create a humidity chamber and promote rusting.
   3. Store assembled frames in a vertical position, five units maximum in a stack. Provide a 2" space between frames to permit air circulation.
   4. Provide proper storage for doors and frames, to maintain the quality and integrity of the factory applied paint, and maintain the requirements of ANSI/SDI A250.10 and HMMA 840.
   5. Sand, touch up and clean prime painted surfaces prior to finish painting in accordance with the manufacturer’s instructions.

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1.9 COORDINATION

A. Coordinate Work with other directly affected sections involving manufacture or fabrication of internal cutouts and reinforcement for door hardware, electric devices and recessed items.

B. Coordinate work with frame opening construction, door and hardware installation.

C. Sequence installation to accommodate required door hardware.

D. Verify field dimensions for factory assembled frames prior to fabrication.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
   1. Steelcraft: www.steelcraft.com/en
      a. Exterior steel doors: Florida NOA: Refer to the “Approved Products” table on drawings for Florida Product Approval and/or NOA numbers.

B. Provide steel doors and frames from a single manufacturer.

C. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
   1. Ceco Door Products; an ASSA ABLOY Group Company
   2. CURRIES Company; an ASSA ABLOY Group Company
   3. Quality Engineered Products Co., Inc.
   4. Firedoor Corporation.

2.2 DOOR TYPES

A. Exterior Door Material: Commercial quality carbon steel conforming to ASTM A568, hot- dipped A60 Galvannealed steel conforming to ASTM A653 or hot dipped G60 galvanized steel. All exterior doors to be galvannealed or hot dipped.
   1. Hurricane Doors: Designed to resist the cyclic pressures, static pressures and missile impact loads as detailed in the Miami-Dade County Product Control Approval System of the Florida Building Code Approval System and meets the requirements of Miami – Dade County test protocols PA 201, PA 202, PA 203 and Florida Building Code test protocols TAS 201, TAS 202 and TAS 203.

B. Interior Door Material: Commercial quality carbon steel conforming to ASTM A568, hot- dipped A40 Galvannealed steel conforming to ASTM A653 or hot dipped G40 galvanized steel.

C. The following door types shall conform to the Steel Door Institute Standards as described in SDI 100.

D. Exterior Doors
   1. Door face sheets shall be formed from one sheet of metal with no face seams. The top and bottom of the door shall be closed with a flush mounted U-channel (not inverted) full width steel closure treatment fabricated from the same gauge as the door.
   2. Core Material
      a. Rigid Polystyrene – R-value 2.36 per ASTM C1363.
      b. Mineral (Equipment rooms and rooms with electrical panels.)
   3. Provide 1-3/4 inch (44 mm) thick doors and in a size width of doors indicated, as required, where full mortise continuous gear hinges are scheduled.
   4. Face sheets shall be hot-dipped galvannealed steel sheets conforming to ASTM A653, Commercial Steel (CS) Class B coating, mill phosphatized.

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5. Provide doors complying with requirements indicated by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level and other indicated requirements.
    a. Rating: Extra Heavy Duty.
    b. Classification: Level 3.
    c. Physical Performance: Level A
    d. Edge: Model 1 – Full Flush
    e. Steel: 16-gauge.
    f. Finish: G90.

E. Interior Doors
1. Door face sheets shall be formed from one sheet of metal with not face seams. Seams on vertical door edges shall be tight, smooth, and devoid of irregularities. The top and bottom of the door shall be closed with a flush U-channel (not inverted) full width steel closure treatment fabricated from the same gauge as the door.
2. A kraft resin impregnated honeycomb core shall be permanently bonded to both door skins with thermal adhesive.
3. Face sheets shall be hot-dipped galvanized steel sheet conforming to ASTM A653, Commercial Steel (CS) Class B coating, mill phosphatized.
4. Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level and other indicated requirements.
    a. Rating: Extra Heavy Duty.
    b. Classification: Level 3
    c. Physical Performance: Level A
    d. Edge: Model 1 – Full Flush.
    e. Steel: 16-gauge.
    f. Finish: G60

F. Lock edge of doors shall be beveled 1/8 inch (3.18 mm) in 2 inches (50.8 mm).

G. Hardware Preparation:
1. Provide minimum hardware reinforcing gauges as required in ANSI/SDI A250.6.
2. Doors and frames shall be reinforced, drilled, and tapped to receive mortised hinges, locks, latches, and flush bolts, as required in ANSI/DHI A115 and ANSI/SDI A250.6.
3. Doors shall be reinforced for specified surface-mounted hardware. Perform drilling and tapping as required.
4. Locate hardware in accordance with ANSI/SDI A250.8.
5. Hardware Reinforcement: Fabricate reinforcement plates from same material as door face sheets to comply with the following minimum sizes:
    a. Hinges: Minimum 7-gauge by 1-1/2 inches (38 mm) wide by 6 inches (152.4 mm) longer than hinge, secured by not less than 6 spot welds.
    b. Pivots: Minimum 7-gauge by 1-1/2 inches (38 mm) wide by 6 inches (152.4 mm) longer than hinge, secured by not less than 6 spot welds.
    c. Lock Face, Flush Bolts, Closers, and Concealed Holders: Minimum 14-gauge.
    d. All Other Surface-Mounted Hardware: Minimum 14-gauge.
6. Hardware preparation shall comply with Miami-Dade NOA or Florida Product Approval.

2.3 FRAME TYPES

A. Frames for exterior door openings.
1. Frames for exterior use shall be fabricated from 14 gauge minimum, G 90 galvanized sheet steel.

B. Frames for interior door openings and borrowed lights.
1. Frame for interior use shall be fabricated from 16 gauge G 60 galvanized sheet steel.

C. Welded Frames: Frames shall be welded with exposed surfaces, dressed smooth and flush. Provide a temporary spreader bar securely fastened to the bottom of each frame.
   1. Frames for exterior use shall have mitered corners with frames welded continuously on the full frame profile and ground smooth to appear seamless.
   2. Frames for interior use shall have mitered corners with frame faces welded and ground smooth to appear seamless.
   3. Welded frames shall be smooth, even, and have no blemishes or irregularities in finish or surface on all exposed sides and planes.
   4. Headers and jambs shall be secured at corners either by external welding with seamless face joints.
   5. Frames shall be provided with temporary spreader bars for shipping and handling purposes.
   6. Knockdown and drywall type frames shall not be used unless dictated by specific project conditions leaving no other reasonable alternative.
   7. Mullions and transom bars shall be joined to adjacent members by welding. Face joints shall be welded and ground smooth (seamless).
   8. Frames shall be provided with a minimum of three anchors per jamb suitable for the adjoining wall construction. Frames over 7’-6” shall be provided with additional wall anchors as required.
   9. In additions, frames shall be provided with minimum 18-gauge base anchor.
   10. Frames shall be furnished in manufacturer’s standard factory-applied coat of rust-inhibiting primer complying with ANSI/SDI A250.10 for acceptance criteria.
   11. Provide 7-gauge universal steel hinge reinforcement and prepare for 4½" x 4½" standard or heavy weight template hinges.
   12. Strike jambs 14-gauge reinforcement

D. Frames for paired doors shall be furnished with a stationary center mullion where indicated.

2.4 FRAME ANCHORS

A. Use steel anchors sized to accommodate frame jamb depth and face dimension on frames.
   1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.07 mm) thick, with corrugated or perforated straps not less than 2 inches (50.8 mm) wide by 10 inches (254 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
      a. Jamb Anchor Locations: Locate jamb anchors not more than 16 inches (406.4 mm) from top and bottom of frame. Space anchors not more than 30 inches (762 mm) o.c., to match coursing, and as follows:
         1) Two anchors per jamb up to 60 inches (1524 mm) high.
         2) Three anchors per jamb from 60 to 90 inches (2286 mm) high.
         3) Four anchors per jamb from 90 to 120 inches (3048 mm) high.
         4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches (609.6 mm) or fraction thereof above 120 inches (3048 mm) high.
      b. Post-installed Expansion Anchors for In-place Concrete or Masonry: Minimum 3/8” diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall with throat reinforcement plate welded to frame at each anchor location.
   2. Stud-Wall Type: Manufacturer’s adjustable type compression anchors at drywall locations. Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.07 mm) thick.
      a. Jamb Anchor Locations: Locate anchors not more than 18 inches (457.2 mm) from top and bottom of frame. Space anchors not more than 30 inches (762 mm) o.c. and as follows:
         1) Three anchors per jamb up to 60 inches (1524 mm) high.
         2) Four anchors per jamb from 60 to 90 inches (2286 mm) high.

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3) Five anchors per jamb from 90 to 96 inches (2438.4 mm) high.
4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches (609.6 mm) or fraction thereof above 96 inches (2438.4 mm) high.

B. Sleeve anchors shall be fire rated for the types of openings required.

C. Floor Anchors: Provide floor angle clip type anchors formed from same material as frames, minimum thickness of 16-gauge for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
1. Anchors to receive 2 fasteners per jamb and welded to bottom of each jamb.
2. Floor anchors may be set with power-actuated fasteners instead of post-installed expansion anchors if so indicated as approved by shop drawings.

D. Masonry and Concrete Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.

2.5 DOOR ACCESSORIES

A. Lites:
1. Glazed Lites: Furnish 20-gauge metal glazing beads of the same type of finish for lites in interior and exterior doors, hollow metal frames and transoms, side lights, interior glazed panels, and other locations where beads are indicated in pressed steel frames.
a. Secure stops with countersunk flat or oval head machine screws spaced uniformly not more than 9” o.c. and not more than 2” from each corner.
b. Exterior glazing beads shall be installed on the exterior side of the frame with tamper-resistant screws to comply with wind loading.

B. Plaster Guards: Provide 26-gauge steel plaster guards or mortar boxes, welded to the frame, at back of door hardware cutouts where mortar or other materials might obstruct hardware operation.

C. Door Silencers: Drill stops and install 3 silencers on strike jambs of single swing frames and 2 silencers on heads of double swing frames.

D. Drip Edge: Provide drip cap at all exterior frames exposed to the elements with no building overhangs to keep rain from hitting the top of the door.
1. Drip Cap: Drip #346 with clear anodized finish as manufactured by Pemko.
a. Manufacturer is as indicated however equal or better performing products of other manufacturers will be considered for acceptance by the Architect.

2.6 FRAME ACCESSORIES

A. Removable Mullion: Provide removable steel mullion with single operation keyed mortise cylinder at paired door locations indicated. The unit shall be self-locking when re-installed without use of cylinder key. The assembly shall be large missile impart rated with document approval.

2.7 FIRE DOORS AND FRAMES

A. Provide approved and labeled hollow metal fire doors and frames at locations indicated in Door Schedule. Approved doors, frames, and hardware shall be constructed and installed in accordance with requirements of NFPA 80 and tested by UL (Underwriter's Laboratories, Inc.) or WH (Warnock Hersey) for the class of door opening indicated in schedules.

B. Labeled metal frames are required for labeled doors.

C. All labels shall be metal, attached to the frame where required by code. Stamped labels will not be acceptable. Labels shall not be painted.

2.8 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

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B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Frame Anchors: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

D. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M, hot-dip galvanized according to ASTM A153/A153M, Class B.

E. Supports and Anchors: Fabricate of not less than 18-gauge galvanized sheet steel.

F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

G. Grout: ASTM C476, except with a maximum slump of 4 inches (101.6 mm), as measured according to ASTM C143/C143M.

H. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where items are to be built into exterior walls, hot-dip galvanize in compliance with ASTM A153, Class C or D as applicable.

I. Loose Fill Mineral Wool: Nodulated mineral fiber loose fill density, 4-6 lbs. cu. Ft., ASTM C764, Type I, Class 1 with maximum flame-spread of 25 and smoke-developed indexes of 50, respectively, per ASTM E84.

J. Bituminous Paint: Cold-applied non-fibered asphalt emulsion complying with ASTM D1227, Type 2 formulated for 30 mill thickness per coat minimum.
   1. Exterior frames shall be coated completely on the inside and at points in contact with masonry or concrete with bituminous mastic coating.
   2. Interior frames set in masonry or concrete walls shall be coated completely on the inside and at points in contact with masonry or concrete with bituminous mastic coating.
   3. Interior frames in partition walls shall be coated on the inside with bituminous mastic coating up to 1 foot (30.48 cm) above the floor.

2.9 FABRICATION, GENERAL

A. Fabricate steel door and frame units to be rigid, neat in appearance, and free from defects, warp, or buckle. Accurately form metal to required sizes and profiles. Wherever practicable, fit and assemble units in the manufacturer's plant. Clearly identify Work that cannot be permanently factory assembled before shipment, to assure proper assembly at the project site. Lock edges of doors shall be beveled 1/8 inch (3.18 mm) in 2 inches (50.8 mm).

B. Panels and edge channels of exterior doors shall be fabricated from galvanized sheet steel. Panels and edge channels of interior doors shall be fabricated from cold rolled sheet steel. Sizes, types, and assemblies shall be as indicated on the Drawings, Door Hardware Schedule, and as specified.

C. Fabricate concealed stiffeners, reinforcement, edge channels, and moldings from either cold rolled or hot rolled steel (at fabricator's option).

D. Exposed Fasteners: Provide countersunk, tamper-resistant, flat Phillips heads for exposed screws and bolts.

E. Provide minimum 12-gauge frame head reinforcement for closers, surface, and concealed overhead stop and holders, removable mullions, flush bolts, and top latch of vertical rod exit devices.

F. Hardware Preparation
   1. Prepare hollow metal units to receive mortised and concealed door hardware, including cutouts, reinforcing, drilling, and tapping in accordance with final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A115 "Specifications for Door and Frame Preparation."

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2. Locate finish hardware as shown on final shop drawings, or if not shown, in accordance with recommended hardware locations specified in "S.D.I. 100-98, Recommended Specifications, Standard Steel Doors and Frames," as published by the Steel Door Institute.
3. Reinforce all steel frames to receive surface mounted closers, whether or not scheduled to receive them.
4. Reinforce hollow metal units to receive surface applied hardware. Drilling and tapping for surface applied door hardware may be done at project site.
5. Hollow metal units shall be reinforced, drilled, and tapped to receive mortised hinges, locks, latches, and flush bolts, as required in ANSI/DHI A115 and ANSI/SDI A250.6.
6. Locate hardware in accordance with ANSI/SDI A250.8.
7. Hardware Reinforcement: Fabricate reinforcement plates from same material as hollow metal units to comply with the following minimum sizes:
    a. Hinges: Minimum 7-gauge by 1-1/2 inches (38 mm) wide by 6 inches (152.4 mm) longer than hinge, secured by not less than 6 spot welds.
    b. Pivots: Minimum 7-gauge by 1-1/2 inches (38 mm) wide by 6 inches (152.4 mm) longer than hinge, secured by not less than 6 spot welds.
    c. Provide minimum 12-gauge frame head reinforcement for closers, surface, and concealed overhead stop and holders, removable mullions, flush bolts, and top latch of vertical rod exit devices.
    d. Provide minimum 14-gauge reinforcement for surface exit devices, floor check hinges and strike jambs.
    e. Provide minimum 16-gauge reinforcement for pull bars.
8. Hardware preparation shall comply with Miami-Dade NOA or Florida Product Approval.

G. Shop Painting
1. Primer: Rust-inhibitive enamel or paint, either air-drying or baking, suitable as a base for specified finish paints complying with ANSI A224.1, "Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames."
2. Clean, treat, and shop paint all surfaces of fabricated hollow metal doors and frames, including galvanized surfaces plus back prime of all hollow metal door frames.
3. Clean steel surfaces of mill scale, rust, oil, grease, dirt, and other foreign materials before the application of the shop coat of paint.
4. Apply shop coat of prime paint of even consistency to provide a uniformly finished surface ready to receive field applied paint.

2.10 SPECIAL COLORS

A. Hollow metal door frames at the floor joint shall have caulking color that matches the hollow metal frame color.

2.11 REFINISHING EXISTING DOORS AND FRAMES

A. Prep existing doors and frames for refinishing:
1. The entire surface of the door and frame shall be sanded completely with appropriate grit sandpaper.
2. Color(s): As selected by Architect.
3. Continue preparations steps to achieve a door and frame finish in compliance with a like new frame.

PART 3 EXECUTION

3.1 EXAMINATION

A. Preparation/Field Verification:
1. Verify that Shop Drawings have been successfully submitted, reviewed, and returned.
2. Verify door frames are in proper location and have been properly anchored in accordance with Specifications and SDI 105 Recommended Erection Instruction for Steel Frames.

3. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and that they have been installed with plumb jambs and level heads.
4. Verify that the correct door hardware has been delivered and doors have been prepped correctly.
5. Proceed with installation of doors only after unsatisfactory conditions have been corrected. Installation of doors and hardware indicates all conditions are satisfactory.

3.2 INSTALLATION

A. General:
1. Inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.
2. Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.
3. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.
4. Provide attachment and connection devices and methods necessary for securing Work. Secure Work true to line and level. Allow for expansion and building movement.
5. Visual Effects: Provide uniform joint widths in exposed Work. Arrange joints in exposed Work to obtain the best visual effect. Refer questionable choices to the Architect for final decision.

B. Install standard steel doors, frames, and accessories in accordance with final shop drawings, manufacturer's data, and as herein specified.

C. Placing Frames: Comply with provisions of SDI-105 "Recommended Erection Instructions for Steel Frames," unless otherwise indicated.
1. Set frames prior to construction of enclosing walls and ceilings. After wall construction is completed, remove temporary braces and spreaders leaving surfaces smooth and undamaged.
2. Install fire-rated frames in accordance with NFPA Standard No. 80.
3. In metal stud partitions, install at least 3 wall anchors per jamb at hinge and strike levels. In closed steel stud partitions, attach wall anchors to studs with screws.
4. Set frames in position; plumb, align, and brace securely until permanent anchors are set. Anchor bottom of frames to floors with expansion bolts or with power fasteners. Where frames require ceiling struts or other structural overhead bracing, they shall be anchored securely to ceilings or structural framing above, as indicated or specified.
5. The finished work shall be rigid, neat in appearance, and free from defects. Form molded members straight and true with joints coped or mitered, well formed, and in true alignment. Welded joints on exposed surfaces shall be dressed smooth so they are invisible after finishing.
6. Provide filler plate at all hardware preps, such as hinge and strike preps, that are unused.
7. Exterior frames shall be filled completely with grout after installation of frame.
8. Interior frames set in masonry or concrete walls shall be filled completely with grout after installation of frame.
9. Coordinate installation of frames to allow for solidly filling space between frames and masonry or concrete with grout. Take precautions including bracing frames to ensure that frames are not deformed or damaged by grout forces.
10. Spot grout fill interior metal frames in gypsum wallboard partitions with gypsum board compound at hinge and strike locations. Fully fill interior frames with gypsum board compound at Music room and mechanical room walls.
11. Solidly pack mineral-fiber insulation inside metal stud partitions frames.
12. Set exterior door lite frames in full bed of sealant and do not over tighten screws. Bent or deformed exterior lite frames will be replaced.

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13. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
    a. Squareness: Plus or minus 1/16 inch (1.59 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch (1.59 mm), measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch (1.59 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch (1.59 mm), measured at jambs at floor.

D. Door Installation: Fit hollow metal doors accurately in frames, within clearances specified in ANSI/SDI-100.
    1. Install fire-rated doors with clearances as specified in NFPA Standard No. 80-07.

E. Provide all items and accessories as required for a complete installation in every respect.

F. Corrosion Protection: Coat surfaces that will come into contact with grout, concrete, masonry, wood, or dissimilar metals and as indicated with a heavy coat of bituminous paint.

3.3 REFINISHING EXISTING DOORS AND FRAMES

A. Prepare existing doors and frames carefully to facilitate refinishing of any imperfections and prepare door and frame to accept new finish.

3.4 FIELD QUALITY CONTROL

A. Damaged work will be rejected and shall be replaced with new work at no additional cost to the Owner or Architect.

B. After installation, protect doors and frames from damage during subsequent construction activities.

C. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections.

D. Testing Services: Testing and inspecting of representative areas of hollow metal assemblies shall take place as installation proceeds to determine compliance of installed assemblies with specified requirements.

E. Test Area for Each Individual Building:
    1. 10% of the total openings.
    2. Perform a minimum of two tests in areas as directed by Architect.

F. Test Types:
    1. Water Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.

G. Repair or remove work if test results and inspections indicate that it does not comply with specified requirements.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

I. Prepare test and inspection reports.

3.5 ADJUSTING, CLEANING AND PROTECTION

A. Remove and replace defective work, including doors or frames that are damaged, bowed or otherwise unacceptable.

B. Prime Coat Touch-up: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.

C. Protection: Provide protective measures required throughout the construction period to ensure that door and frame units will be without damage or deterioration, other than normal weathering, at time of acceptance.
   1. Protection Removal: Immediately prior to final inspection, remove protective plastic wrappings from prefinished doors.

D. Final Adjustments:
   1. Adjust operating doors and hardware items just prior to final inspection and acceptance by the Owner and Architect.
   2. Check and readjust operating hardware items, leaving steel doors and frames undamaged and in complete and proper operating condition.

END OF SECTION

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SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Solid-core doors and transom panels with wood-veneer faces.
   2. Factory finishing flush wood doors.
   3. Factory fitting flush wood doors to frames and factory machining for hardware.
   4. Refinishing existing doors.

1.3 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.

B. ASTM D1037 - Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials; 2012 (Reapproved 2020).

C. ASTM D3498 - Standard Specification for Adhesives for Field-Gluing Wood Structural Panels (Plywood or Oriented Strand Board) to Wood Based Floor System Framing; 2019a.

D. ASTM E413 - Classification for Rating Sound Insulation; 2022.

E. ASTM F476 - Standard Test Methods for Security of Swinging Door Assemblies; 2023.

F. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2025.

G. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives; 2025.

H. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.

I. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

J. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

K. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.

L. WDMA I.S. 1A - Interior Architectural Wood Flush Doors; 2021, with Errata (2022).

M. ASTM E152 – Methods of Fire Tests and Door Assemblies.

N. ASTM E2074 – Standard Methods of Fire Tests of Door Assemblies, Including Positive Pressure Testing of Side-Hinged and Pivoted Swinging Door Assemblies.

O. AWI – Quality Standards of the Architectural Woodwork Institute.

P. WDMA – Window & Door Manufacturers Association.

Q. HPMA HP – Hardwood and Decorative Plywood.

R. ANSI A115.1 W Series, Wood Door Hardware Standards.

S. Warnock Hersey – Certified Listings for Fire Doors.

T. WDMA Industry Standards 1.S.I-A-97 – Window and Doors Manufacturer Association.

U. Window and Door Manufacturers Association – WDMA I.S. 10 Industry Standard for Testing Cellulosic Composite Materials for Use in Fenestration Products.

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1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements, for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 – Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 – Product Requirements for substitution procedures

C. Product Data: For each type of door. Include details of core and edge construction, and trim for openings. Include factory-finishing specifications.

D. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
   1. Dimensions and locations of blocking, cutouts, undercuts and mortises and holes for hardware.
   2. Dimensions for Undercuts. Requirements for veneer matching.
   3. Fire-protection ratings for fire-rated doors.

E. Samples:
   1. Corner sections of doors, approximately 8 by 10 inches (254 mm), with door faces and edges representing actual materials to be used.
      a. Provide samples for each species of veneer and solid lumber required.
      b. Provide set of three (3) samples showing full ranges of color and grain to be expected in the finish work.
      c. Finish veneer-faced door samples with same materials proposed for factory- finished doors.
   2. Lite and frame sections, 6 inches (152.4 mm) long, for each material and finish specified.

F. Sample Warranty: For special warranty.

G. Quality Standard Compliance Certificates: AWI or WDMA Quality Certification Program certificates.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body and is a certified participant in AWI's or WDMA’s Quality Certification Program.

B. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

C. Quality Standard: In addition to requirements specified, comply with WDMA I.S. 1A, "Architectural Wood Flush Doors."
   1. Provide AWI or WDMA Quality Certification Labels indicating that doors comply with requirements of grades specified or provide a letter of certification.
   2. Contract Documents contain selections chosen from options in quality standard and additional requirements beyond those of quality standard. Comply with those selections and requirements in addition to quality standard.

D. Contractor Qualifications: Employ only experienced Contractors (Installers) skilled in the successful installation of the specified materials and assemblies on similar projects for a minimum of five years.

1.7 PERFORMANCE REQUIREMENTS

A. Fire Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.

B. Smoke Control Door Assemblies: Comply with NFPA 105.

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1. Smoke "S" Label: Doors to bear “S” label and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.

C. Security Comply with ASTM F476-84 Level 40.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.

C. Mark each door top and bottom rail with opening number used on Shop Drawings.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 degrees Fahrenheit (32.22 degrees Celsius) and relative humidity between 43 and 70 percent during remainder of construction period.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Warping (bow, cup, or twist) more than 1/4 inch (6.35 mm) in a 42-by-84-inch section.
      b. Telegraphing of core construction in face veneers exceeding 0.01 inch (0.25 mm) in a 3-inch span.
      c. Delamination of veneer from core.
   2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
   3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer(s) for products shall be one of the following. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
   1. VT Industries, Inc.

B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
   1. Algoma Hardwoods, Inc.
   2. Eggers Industries
   3. Graham Wood Doors; an Assa Abloy Group Company
   4. Ipik Door Company
   5. Marshfield Door Systems, Inc.
   6. Mohawk Doors; a Masonite Company
   7. Oshkosh Door Company
   8. Vancouver Door Company

2.2 FLUSH WOOD DOORS

A. Solid-Core Doors:
   1. Core: Structural composite lumber core, either glued wood stave or structural lumber AWI Type SLC-5 or SLC-7 or WDMA equivalent.
      a. Construction: Five or seven plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering. Faces are bonded to core using a hot press.

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2. Construction: Indicated number of plies with stiles and rails bonded to core then entire unit abrasive planed before faces are applied.
3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
    a. Screw Withdrawal, Face: 700 lbf
    b. Screw Withdrawal, Edge: 400 lbf per WDMA T.M.-10.

B. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252.
1. Temperature-Rise Limit: Where indicated, provide doors that have a maximum transmitted temperature end point of not more than 450 degrees Fahrenheit (232.22 degrees Celsius) above ambient after 30 minutes of standard fire-test exposure.
2. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
3. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as follows:
    a. 5-inch top-rail blocking.
    b. 5-inch bottom-rail blocking, in doors indicated to have protection plates.
    c. 5-inch midrail blocking, in doors indicated to have armor plates.
    d. 5-inchmidrail blocking, in doors indicated to have exit devices.
4. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
5. Pairs: Provide formed-steel edges and astragals with intumescent seals.
    a. Finish steel edges and astragals with baked enamel.

C. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.

D. Astragals for Fire Rated Double Doors: Steel, T shaped, overlapping and recessed at face edge specifically for double doors.

2.3 VENEER-FACED DOORS

A. Interior Solid-Core Doors:
1. Grade: Premium, with Grade AA faces.
2. Species: Select white birch (Wood shall be clear, heartwood, noticeable dark wood, dark spots, and streaks are not allowed).
3. Cut: Plain sliced.
4. Thickness: 1 3/4"
5. Match between Veneer Leaves: Book match.
6. Assembly of Veneer Leaves on Door Faces: Balance match
7. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions, balanced match finish.
8. Room Match: Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 10 feet (304.8 cm) or more.
9. Transom Match: Continuous match.
10. Exposed Vertical and Top Edges: Same species as faces - edge Type A, minimum 1 1/8” after trimming.
11. WDMA I.S. 1A Aesthetic Grade, Heavy Duty Performance Grade.
12. Adhesive: Interior use, Type II.

2.4 LITE FRAMES

A. Metal Frames for Lite Openings in Wood Doors: All vision panels shall be of a size as indicated on drawings with manufacturer’s standard metal frames.

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B. Metal frames for Lite Openings in Fire Doors: Manufacturer's standard metal frames approved for use in doors of fire rating indicated. Include concealed metal glazing clips where required for opening size and fire rating indicated.
   1. Coordinate frame size to conform to fire glass thickness.

C. Frames to have countersunk holes and tamper proof fasteners.

D. Color: As selected by the Architect.

2.5 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
   1. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.

C. Openings: Factory cut and trim openings through doors.
   1. Lite Openings: Trim openings with moldings of material and profile indicated.
   2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Specification Section "Glazing".

2.6 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
   1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Factory door finish:
   1. Grade: Premium.
   2. Finish: WDMA TR-4 conversion varnish or WDMA TR-6 catalyzed polyurethane.
   3. Staining: Stain shall be as selected by the Architect.
   4. Effect: Filled finish.
   5. Sheen: Satin.

2.7 REFINISHING EXISTING DOORS

A. General: Immediately prior to staining and refinishing, the entire surface of the door shall be sanded complete with appropriate grit sandpaper while door is in a horizontal position. Continue preparations steps to achieve a AWI wood finish in compliance with a like new door.
   1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Refinished door finish:
   1. Grade: Premium.
   2. Finish: WDMA TR-4 conversion varnish or WDMA TR-6 catalyzed polyurethane.
   3. Staining: Stain shall be as selected by the Architect.
   4. Sheen: Satin.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.
   1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
   2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

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3.2 INSTALLATION

A. Hardware: For installation, see specification section "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
   1. Install fire-rated doors according to NFPA 80.
   2. Install smoke- and draft-control doors according to NFPA 105.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

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SECTION 08 31 00 - ACCESS DOORS AND PANELS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein

1.2 SECTION INCLUDES

A. Ceiling-mounted access units.

1.3 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

C. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2026.

D. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2025.

E. FM (AG) - FM Approval Guide; Current Edition.

F. ITS (DIR) - Directory of Listed Products; Current Edition.

G. UL (FRD) - Fire Resistance Directory; Current Edition.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 - Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 – Product Requirements for substitution procedures.

C. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

D. Shop Drawings: Indicate exact position of each access door and/or panel unit.

E. Samples: Submit two access units, in size indicating frame configuration and anchors.

F. Manufacturer's Installation Instructions: Indicate installation requirements.

G. Project Record Documents: Record actual locations of each access unit.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.

1. Milcor, Inc. and as indicated.

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B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product.
   1. Access Panel Solutions.
   2. Jensen Industries; Div. of Broan-Nutone, LLC.
   3. J. L. Industries, Inc.; Div. of Activar Construction Products Group.
   4. Larsen's Manufacturing Company.
   5. Nystrom, Inc.

C. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.

2.2 ACCESS DOORS AND PANELS ASSEMBLIES

A. Interior Flush Access Doors with Exposed Flanges (Primed Steel)
   1. Basis-of-Design: “Style M”
   2. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard-width exposed flange, proportional to door size.
   3. Locations: Wall and ceiling.
   4. Material: 16-gauge door and 16-gauge frame.
   5. Door Size: Size appropriate for concealed items to be accessed, minimum 12" x 12".
   6. Finish: Primed Sheet for Door and frame.
   7. Hinges: Manufacturer's standard.
   8. Hardware: Cam lock.

B. Interior Flush Access Doors with Exposed Flanges (Stainless Steel): Restrooms, Custodial Closets, and all Wet Locations:
   1. Basis-of-Design: “Style MS”
   2. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard-width exposed flange, proportional to door size.
   3. Locations: Wall and ceilings.
   4. Material: 16-gauge door and 16-gauge frame.
   5. Door Size: Size appropriate for concealed items to be accessed, minimum 12" x 12".
   6. Stainless-Steel Sheet for Door and Frame: Nominal 0.062 inch, 16-gauge with No. 4 finish.
   7. Hinges: Manufacturer's standard.
   8. Hardware: Cam lock.

C. Exterior Flush Access Doors (Stainless Steel):
   1. Basis of Design Product: “Style MS”
   2. Assembly Description: Fabricate door to be weatherproof and fit flush to frame. Provide manufacturer's standard 2-inch thick fiberglass insulation and extruded door gaskets. Provide manufacturer's standard-width frame for surface mounting, proportional to door size.
   3. Locations: Wall or Soffit.
   4. Material: 16-gauge door and 16-gauge frame.
   5. Door Size: Size appropriate for concealed items to be accessed, minimum 12" x 12".
   6. Stainless-Steel Sheet for Door & Frame: Nominal 0.062 inch, 16-gauge with No. 4 finish.
   7. Hinges: Manufacturer's standard.
   8. Hardware: Cam latch and lock

2.3 HARDWARE

A. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
   1. Latch Type: Screwdriver operated cam lock.
   2. Cylinder Locks: Furnish two (2) keys per lock and key all locks alike.

2.4 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

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B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

D. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063.

E. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

F. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304. Remove tool and die marks and stretch lines or blend into finish.

G. Frame Anchors: Same type as door face.

H. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.5 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access doors to types of supports indicated.
   1. For concealed flanges with drywall bead, provide edge trim for gypsum board securely attached to perimeter of frames.
   2. For concealed flanges with plaster bead for full-bed plaster applications, provide zinc- coated expanded metal lath and exposed casing bead welded to perimeter of frames.
   3. Provide mounting holes in frames for attachment of units to metal framing.
   4. Provide mounting holes in frame for attachment of masonry anchors.

2.6 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Stainless Steel Finishes:
   1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
   2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
   3. Finish: #4 Satin

E. Steel Finish:
   1. Factory primed.

F. Aluminum: Mill

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that rough openings are correctly sized and located.

B. Begin installation only after substrates have been properly prepared, and if the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to proceeding with this work.

B. Prepare surfaces using methods recommended by manufacturer for applicable substrates in accordance with project conditions.

3.3 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install frames plumb and level in openings, and secure units rigidly in place.

C. Position units to provide convenient access to concealed equipment when necessary.

END OF SECTION

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SECTION 08 41 13 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INLCUDES

A. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Exterior storefront system.
   2. Exterior storefront window system.
   3. Interior storefront system.
   4. Operable window system.

1.3 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.

B. AAMA 501.1 - Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure; 2017.

C. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems; 2015.

D. AAMA 502 - Voluntary Specification for Field Testing of Newly Installed Fenestration Products; 2021.

E. AAMA 612 - Voluntary Specification, Performance Requirements, and Test Procedures for Combined Coatings of Anodic Oxide and Transparent Organic Coatings on Architectural Aluminum; 2020, with Errata (2022).

F. AAMA 701/702 - Performance Specification for Pile Weatherstrips (AAMA 701) and Polymer Weatherseals (AAMA 702); 2023.

G. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.

H. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

I. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

J. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

K. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.

L. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2025.

M. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

N. ASTM B308/B308M - Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles; 2020.

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O. ASTM D2000 - Standard Classification System for Rubber Products in Automotive Applications; 2018.

P. ASTM D2287 - Standard Classification System and Basis for Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds; Current Edition.

Q. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.

R. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2023).

S. ASTM E413 - Classification for Rating Sound Insulation; 2022.

T. ASTM E699 - Standard Specification for Agencies Involved in Testing, Quality Assurance, and Evaluating of Manufactured Building Components; 2016.

U. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors; 2002 (Reapproved 2018).

V. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2015 (Reapproved 2023).

W. ASTM E1332 - Standard Classification for Rating Outdoor-Indoor Sound Attenuation; 2022.

X. ASTM F588 - Standard Test Methods for Measuring the Forced Entry Resistance of Window Assemblies, Excluding Glazing Impact; 2017 (Reapproved 2023).

Y. BHMA A156.16 - Standard for Auxiliary Hardware; 2023.

Z. BHMA A156.21 - Thresholds; 2025.

AA. AA (Aluminum Association) – Designation System for Aluminum Finishes.

BB. AAMA Series number 11 – Design Wind Loads for Buildings and Boundary Layer Wind Tunnel Testing.

CC. AAMA 101 – Standard Specification for Window, Doors, and Skylights.

DD. AAMA 200 – Standard Practice for the Installation of Windows with Frontal Flanges for Surface Barrier Masonry Construction.

EE. AAMA 511 – Voluntary Guideline for Forensic Water Penetration Testing of Fenestration Products.

FF. ASTM B209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

GG. ASTM C509 – Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material.

HH. ASTM E283 – Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen.

II. ASTM E330 – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements, for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 – Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 – Product Requirements for substitution procedures.

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C. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

D. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.
   2. For entrance doors, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.

E. Samples: For units with factory-applied finishes.
   1. Fabrication Sample: Of each vertical-to-horizontal intersection of aluminum-framed systems, made from 12-inch lengths of full-size components and showing details of the following:
      a. Joinery, including concealed welds.
      b. Anchorage.
      c. Expansion provisions.
      d. Glazing.
      e. Flashing and drainage.

F. Qualification Data: For qualified Installer and testing agency.

G. Energy Performance Certificates: For glazed storefront systems, accessories, and components, from manufacturer.
   1. Basis for Certification: NFRC-certified energy performance values for each glazed storefront system.

H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems, indicating compliance with performance requirements.

I. Warranties: Sample of special warranties.

J. Maintenance Data: For glazed storefront systems to include in maintenance manuals.

K. Delegated-Design Submittal: Contractor shall engage a qualified professional engineer, licensed in the State of Florida, to design calculations, analysis data, and shop drawings - indicating compliance with dedicated design requirements, and signed and sealed by the qualified Florida registered professional engineer responsible for their preparation.

L. Exterior Product Approvals: Manufacturer shall submit documentation that product complies with large and small missile impact criteria and has been tested and approved in compliance with Florida Product Approval or Miami Dade NOA and applicable requirements.

1.6 QUALITY ASSURANCE

A. Manufacturer’s Qualifications:
   1. Provide products from a firm that makes the indicated products as a regular production item and with not less than ten (10) years experience.
   2. Manufacturer Qualifications: A manufacturer capable of fabricating glazed aluminum storefront and entrance systems that meet or exceed energy performance requirements indicated and of documenting this performance by certification, labeling, and inclusion in lists.

B. Installer Qualifications:
   1. Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
   2. An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation of specified materials and assemblies with not less than five (5) years experience.

C. Testing Agency Qualifications: Qualified according to ASTM E699 for testing indicated.

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D. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.
   1. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.

E. Energy Performance Standards: Comply with NFRC for minimum standards of energy performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.
   1. Provide NFRC-certified glazed aluminum storefront systems with an attached label.

F. Accessible Entrances: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.

G. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.

H. Exterior Product Approvals: Manufacturer shall certify that product complies with large and small missile impact criteria and has been tested and approved in compliance with Florida Product Approval or Miami Dade NOA and applicable requirements.

1.7 MOCK-UPS

A. Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

B. Build mockup of typical wall area as indicated by the Architect.

C. Field testing shall be performed on mockup according to requirements in "Field Quality Control" Article.

D. Approval of mockup does not constitute approval of deviations from the Contract Documents contained in mockup unless Architect specifically approves such deviations in writing.

E. Approved mockup may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 PRE-INSTALLATION MEETING

A. The Contractor shall conduct a pre-installation meeting at the project site a minimum of 30 days prior to any work being installed as indicated in this section and other related sections that require coordination with this section.

B. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

C. Review and discuss the finishing that is required to be coordinated with the finishing of other aluminum work for color and finish matching.

D. Review, discuss, and coordinate the interrelationship with other exterior wall components. Include provisions for anchoring, flashing, weeping, sealing perimeters, and protecting finishes.

E. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.

F. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

1.9 FIELD CONDITIONS

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A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1.10 WARRANTY

A. Warranty: Standard form in which manufacturer and installer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

B. Failures include, but are not limited to, the following:
   1. Structural failures including, but not limited to, excessive deflection.
   2. Noise or vibration caused by thermal movements.
   3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   4. Adhesive or cohesive sealant failures.
   5. Water leakage through fixed glazing and framing areas.
   6. Failure of operating components.

C. Warranty Period for installer: Two (2) years from date of Substantial Completion.

D. Warranty Period for manufacturer: Five (5) years from date of Substantial Completion.

E. Warranty Period for Anodized finish: Ten (10) years from date of Substantial Completion.

1.11 MAINTENANCE SERVICE

A. Entrance Door Hardware:
   1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.

1.12 PERFORMANCE REQUIREMENTS

A. General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Movements of supporting structure indicated on drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.

C. Dimensional tolerances of building frame and other adjacent construction.

D. Failure includes the following:
   1. Deflection exceeding specified limits.
   2. Thermal stresses transferring to building structure.
   3. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
   4. Glazing-to-glazing contact.
   5. Noise or vibration created by wind and by thermal and structural movements.
   6. Loosening or weakening of fasteners, attachments, and other components.
   7. Sealant failure.
   8. Failure of operating units.

E. Structural Loads:
   1. Wind Loads: Basic wind speed, importance factor and exposure category shall be as indicated on drawings.

F. Deflection of Framing Members:
   1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet (396.24 cm) 6 inches (152.4 mm) and to 1/240 of clear span plus 1/4 inch (6.35 mm) for spans greater than 13 feet 6 inches and shall also comply with the impact certification requirements.

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2. Deflection Parallel to Glazing Plane: Limited to L/360 of clear span or 1/8 inch (3.18 mm), whichever is smaller and shall comply with the impact certification requirements.

G. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:
   1. Wind Loads: Basic wind speed, importance factor and exposure category shall be as indicated on drawings.
   2. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet (396.24 cm) 6 inches (152.4 mm) or 3/4".

H. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas to comply with manufacturers testing of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft. (300 Pa).

I. Water Penetration:
   1. Under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
   2. Under Dynamic Pressure: Provide aluminum-framed systems that do not evidence water leakage through fixed glazing and framing areas when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.

J. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 degrees Fahrenheit (48.89 degrees Celsius), ambient; 180 degrees Fahrenheit (82.22 degrees Celsius), material surfaces.
   2. Test Performance: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.
      a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 degrees Fahrenheit (82.22 degrees Celsius).
      b. Low Exterior Ambient-Air Temperature: 0 degrees Fahrenheit (-17.78 degrees Celsius).
      c. Interior Ambient-Air Temperature.

K. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 45.

L. Thermal Conductance: Provide aluminum-framed systems with fixed glazing and framing areas having an average U-factor of not more than 0.57 Btu/sq. ft. x h x deg F.
   1. Temperature Change (Range): 120 degrees Fahrenheit (48.89 degrees Celsius), ambient; 180 degrees Fahrenheit (82.22 degrees Celsius), material surfaces.
   2. Test Interior Ambient-Air Temperature: 75 degrees Fahrenheit (23.89 degrees Celsius).
   3. Test Performance: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.

M. Sound Transmission: Provide aluminum-framed systems with fixed glazing and framing areas having the following sound-transmission characteristics:
   1. Sound Transmission Class (STC): Minimum 32 STC when tested for laboratory sound transmission loss according to ASTM E90 and determined by ASTM E413 and ASTM E1332.

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N. Delegated-Design: Contractor shall engage a qualified professional engineer, licensed in the State of Florida, to design calculations, analysis data, and shop drawings - indicating compliance with dedicated design requirements, and signed and sealed by the qualified Florida registered professional engineer responsible for their preparation.

O. Exterior Product Approvals: Manufacturer shall certify that product complies with large and small missile impact criteria and has been tested and approved in compliance with Florida Product Approval or Miami Dade NOA and applicable requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
   1. YKK AP American, Inc.

B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
   1. Kawneer
   2. EFCO

2.2 FRAMING SYSTEMS

A. Basis of Design:
   1. Florida NOA: Refer to the “Approved Products” table on drawings for Florida Product Approval and/or NOA numbers.
   2. Exterior: “YHS – 50TU” Insulated, Impact Rated, Thermal Broken.
   3. Interior: “YES – 45FS”.

B. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.
   1. Glazing System: Retained mechanically with gaskets on four sides.
   2. Glazing Plane: Center.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

D. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
   1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
   2. Reinforce members as required to receive fastener threads.

E. Anchors: Three-way adjustable anchors with minimum adjustment of that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

F. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

G. Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.

2.3 ENTRANCE DOOR SYSTEMS

A. Basis of Design: Florida NOA: Refer to the “Approved Products” table on drawings for Florida Product Approval and/or NOA numbers.
   1. Exterior – “50 H”, insulate glazing, impact rated
   2. Interior – “50 D”

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B. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.
   1. Door Construction: Fabricate from extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
   2. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.
      a. Provide nonremovable glazing stops on outside of door and frame.

2.4 ENTRANCE DOOR HARDWARE

A. General: Provide entrance door hardware for each entrance door to comply with requirements per the Florida Product Approval, the Florida Building Code and requirements indicated below, however the requirements of the Florida Product Approval and Florida Building Code shall take precedence.
   1. Entrance Door Hardware Sets per Door Hardware specification section.
   2. Opening-Force Requirements:
      a. Egress Doors: Not more than 8.5 lbf to open the door to its minimum required width.
      b. Accessible Interior Doors: Not more than 5 lbf to fully open door.

B. Opening-Force Requirements:
   1. Latches and Exit Devices: Not more than 5 lbf required to release latch.

C. Weather Stripping: Manufacturer's standard replaceable components.
   1. Compression Type: Made of ASTM D2000, molded neoprene, or ASTM D2287, molded PVC.
   2. Sliding Type: AAMA 701, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

D. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.

E. Silencers: BHMA A156.16, Grade 1.

F. Thresholds: BHMA A156.21, raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch (12.7 mm).

2.5 OPERABLE WINDOWS

A. Basis of Design Product: Florida NOA: Refer to the “Approved Products” table on drawings for Florida Product Approval and/or NOA numbers.
   1. “YOW 225 TUH” Project-Out Window.
      a. Sections shall be extruded from 6063-T5 and 6063-T6 aluminum alloy.
      b. Corner construction shall consist of 45-degree mitered vent and frame construction with staked corner joinery.
      c. Screws, miscellaneous fastening devices, and internal components shall be of stainless steel, plated, or corrosion-resistant materials of sufficient strength to perform the functions for which they are used.
      d. Provide compressible neoprene weatherstripping at window.
      e. All dissimilar metals must be properly insulated to prevent galvanic action.
      f. Provide stainless four bar hinges with cast white bronze cam handles.
      g. Aluminum windows shall receive hardware complying with the Florida Product Approval as required by frame and window manufacturer and shall match the storefront frame finish.

2.6 GLAZING SYSTEMS

A. Glazing: As specified in specification section “Glazing.”

B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.

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C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

E. Glazing Sealants: As recommended by manufacturer for joint type.
   1. Color: As selected by Architect from manufacturer's full range of colors.

2.7 ACCESSORY MATERIALS

A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in specification section "Joint Sealants."

B. Bituminous Paint: Cold-applied, non-fibered asphalt emulsion complying with ASTM D1227, Type 2 requirements formulated for 30-mil (0.762-mm) thickness per coat.

2.8 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
   1. Sheet and Plate: ASTM B 209 (ASTM B 209M).
   2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221 (ASTM B 221M).
   3. Extruded Structural Pipe and Tubes: ASTM B 429.
   4. Structural Profiles: ASTM B308/B308M.

B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
   1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
   2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
   3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.

2.9 SILL PAN AT EXTERIOR STOREFRONT

A. Provide .125 inch (3.18 mm) aluminum sill pan with 1/4" upturn at inside edge.

B. Finish shall match storefront system.

2.10 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
   1. Profiles that are sharp, straight, and free of defects or deformations.
   2. Accurately fitted joints with ends coped or mitered.
   3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
   4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
   5. Provisions for field replacement of glazing from exterior.
   6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

C. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
   1. At exterior doors, provide compression weather stripping at fixed stops.

D. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
   1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
   2. At exterior doors, provide weather sweeps applied to door bottoms.

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E. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

F. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.11 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Sections shall be free of scratches and other serious surface blemishes and chemically cleaned.

B. Aluminum Surfaces: Sections shall be free of scratches and other serious surface blemishes and chemically cleaned.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

E. Clear Anodic Finish: Mechanical Finish, nonspecular as fabricated Chemical Finish, etched Anodic Coating, clear coating 0.7mils or thicker complying with AAMA 612. Complying with paint manufacturer's written instructions for cleaning, preparing, pretreating and apply coating to exposed metal surfaces.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:
   1. Comply with manufacturer's written instructions.
   2. Do not install damaged components.
   3. Fit joints to produce hairline joints free of burrs and distortion.
   4. Rigidly secure nonmovement joints.
   5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
   6. Seal joints watertight unless otherwise indicated.

B. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.

C. Corrosion Protection: Coat concealed surfaces that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

D. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

E. Set continuous sill members and flashing in full sealant bed per specification section "Joint Sealants" to produce weathertight installation.

F. Sill Pan Installation: Install sill pan in full bed of sealant on concrete slab prior to installing system.

G. Install components plumb and true in alignment with established lines and grades, and without warp or rack.

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H. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

I. Install perimeter joint sealants as specified in specification section "Joint Sealants" to produce weathertight installation.

J. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping. Indicate entrance door hardware mounting heights on drawings or insert in subparagraph below.
   1. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

K. Install glazing as specified in specification section "Glazing."

3.3 ERECTION TOLERANCES

A. Install aluminum-framed systems to comply with the following maximum erection tolerances:
   1. Location and Plane: Limit variation from true location and plane to 1/8 inch (3.18 mm) in 10 feet (304.8 cm); 1/4 inch (6.35 mm) over total length.
   2. Alignment:
      a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch (1.59 mm).
      b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch (0.79 mm).

B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch (3.18 mm).

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections.

B. Testing Services: Testing and inspecting of representative areas of glazed aluminum framed assemblies shall take place as installation proceeds to determine compliance of installed assemblies with specified requirements.

C. Test Area for Each Individual Building:
   1. One bay area, but not less than 30 feet (914.4 cm), by one story of glazed aluminum framed assemblies.
   2. 5% of windows but not less than four windows,
   3. Multi story building shall be open bay area and windows as indicated on each floor.
   4. Perform a minimum of two tests in areas as directed by Architect.

D. Test Types:
   1. Air Infiltration: Areas shall be tested for air leakage as indicated on manufacturers test of fixed wall area when tested according to ASTM E783 at a minimum static-air-pressure differential of 6.24 lbf/sq. ft.
   2. Water Penetration: Areas shall be tested according to ASTM E1105 at a minimum uniform and cyclic static-air-pressure differential of not less than 6.24 lbf/sq. ft. and shall not evidence water penetration.
   3. Water Spray Test (To be used if area is too big to accommodate a pressure chamber): Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.

E. Repair or remove work if test results and inspections indicate that it does not comply with specified requirements.

F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

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G. Aluminum framed assemblies will be considered defective if they do not pass tests and inspections.

H. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.

1. For entrance doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches (76.2 mm) from the latch, measured to the leading door edge.

END OF SECTION

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SECTION 08 71 00.0 - DOOR HARDWARE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Hardware for wood and hollow steel doors.
   2. Lock Cylinders for gates, folding partitions, wire cages and doors.
   3. Thresholds.
   4. Gaskets.
   5. Screws, bolts, expansion shields and related prep work.
   6. Hardware layout templates.
   7. Keys key cabinet and Knox Box.

1.3 REFERENCE STANDARDS

A. BHMA A156.3 - Exit Devices; 2025.

B. BHMA A156.4 - Door Closers and Pivots; 2024.

C. Florida Building Code (FBC) - Florida Building Code; 2023.

D. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2025.

E. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

G. ANSI A117.1 – Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.

H. AWI – Architectural Woodwork Institute.

I. BHMA – Builders' Hardware Manufacturers Association.

J. DHI – Door and Hardware Institute.

K. Florida Fire Prevention Code.

L. NAAMM – National Association of Architectural Metal Manufacturers.

M. SDI – Steel Door Institute.

1.4 REFERENCES

A.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 - Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 - Product Requirements for substitution procedures.

C. Submittals shall identify each door and each set number following numbering system noted on Drawings.

D. Manufacturing order shall not be placed until hardware schedule has been submitted and reviewed by Architect.

E. Furnish templates to facilitate work schedule.

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F. Indicate locations and mounting heights of each type of hardware.

G. Submit samples of hinge, latch set, exit device, door closer, thresholds, illustrating style, color, and finish.

H. Project samples may be incorporated in Work.

I. Submit operation and maintenance data in accord with Section 01 78 00 – Closeout Submittals.

J. Include data on operating hardware, and inspection procedures related to preventative maintenance.

K. Certifications:
   1. Architectural Hardware Consultant shall inspect complete installation and certify that hardware and installation has been furnished and installed in accord with manufacturer's printed instructions and as specified.
   2. Provide two copies of certifications to Architect.

1.6 QUALITY ASSURANCE

A. Manufacturers: Company shall specialize in manufacturing door hardware with five years continuous experience.

B. Hardware Supplier: Company shall specialize in supplying institutional door hardware with five years continuous documented experience, approved by manufacturer.

C. Hardware Supplier Personnel: Employ Architectural Hardware Consultant (AHC) on project.

1.7 PERFORMANCE REQUIREMENTS

A. Conform to Florida Building Code for requirements applicable to fire rated doors, frames, and accessibility for physically disabled.

B. Conform to Florida Fire Prevention Code and applicable sections of NFPA 101.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and protect products in original packaging to site.

B. Hardware Packaging
   1. Items shall be individually labeled and identified with door opening code and hardware group to match hardware schedule.
   2. Each item shall identify door location by number identified on Door Schedule.

C. Hardware manufacturers shall deliver via security shipping following items to District Maintenance Dept., 2485 SE Dixie Hwy., Stuart, FL 34996:
   1. Two copies of factory key biting schedule.
   2. Permanent building keys and construction key voiding devices.

D. Protect hardware from theft by cataloging and storing in secured area.

1.9 WARRANTY

A. Provide five-year warranty period in accord with Section 01 78 00 – Closeout Submittals for locksets, latch sets, exit devices hinges and items listed in the hardware schedule excluding overhead door closers.

B. Provide ten-year warranty period in accord with Section 01 78 00 – Closeout Submittals for overhead door closers.

1.10 MAINTENANCE MATERIALS

A. Provide special wrenches and tools applicable to different or special hardware component.

B. Provide maintenance tools and accessories supplied by hardware component manufacturer.

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PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
   1. Corbin/Russwin: NGP.
   2. Glynn-Johnson: BLY.
   3. Hager: HAG.
   4. Ives: IVE.
   5. LCN Closers: LCN.
   6. Best: BES.
   7. Von Durprin: VON.
   8. Pemko: PEM
   9. B/O: Supplied by other trades.

B. Obtain each kind of hardware from one manufacturer.

C. Acceptable products and manufacturers are listed below:
   1. Hinges: Ives, Hager, Stanley, Bommer.
   2. Locks and Latches: Best Access (No Substitution Permitted).
   3. Cylinders, Keys, Keying: Corbin/Russwin (No Substitution Permitted).
   4. Exit Devices: Von Duprin (No Substitution Permitted).
   5. Removable Mullions: Von Duprin (No Substitution Permitted).
   6. Door Closers: LCN (No Substitution Permitted).
   7. Overhead Stops/Holders: Glen Johnson, Rixon.
   8. Wall/Floor Stops/Flush Bolts: Ives, Rockwood, Glen Johnson.
   9. Kick Plates: Ives, Rockwood, Quality.
   10. Thresholds/Weatherstripping: National Guard, Zero, Pemko.
   11. Silencers: Ives, Rockwood, Quality, Glen Johnson.
   12. Push/Pulls: Quality, Rockwood.
   13. Key Cabinet: Lund, Key Control, Telkey.

2.2 HARDWARE FINISH

A. Hardware shall have the following finishes:

B. Exterior Hinges: Stainless Steel (32D).
   1. Interior Hinges/Locks/Exit Devices/Overhead Holders: Satin Chrome (26D).
   2. Door Closers: Aluminum.
   3. Flat Goods: Stainless Steel (32D) or Satin Chrome (26D).
   4. Thresholds: Mill Finish Aluminum.

2.3 HINGES AND PIVOTS

A. Exterior butts shall be stainless steel (32D). Butts on all out-swinging doors shall be furnished with non-removable pins (NRP). Size: 4½" wide x 4½" high, for exterior doors up to 42” wide and heavy weight 4½" wide x 4½" high hinges for doors over 42” wide.

B. Interior butts shall be steel, standard weight 4½" wide x 4½" high hinges doors up to 42” wide
   1. and heavy weight 4½" wide x 4½" high hinges for doors over 42” wide.

C. Doors less than 5’-0” high shall have two (2) butts. Furnish one (1) additional butt for each 2’- 6” of height or fraction thereof.

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2.4 KEYING

A. Pre-Order Meeting: Hardware supplier shall meet with District's Maintenance Lock Dept. Representative to establish keying order before lock order is placed.

B. Locks shall be construction master keyed using split key method keyed to School District's
   1. restricted keyway.

C. Hardware supplier shall meet with District's Maintenance Lock Dept. Representative will establish final count of locks and cylinders and transmit release order to Best Access Systems Lock Company for production in amounts established with Hardware Supplier.

D. Construction keys in following quantities:
   1. 12 master keys

E. Supply permanent keys in following quantities:
   1. Six keys for each lock with maximum of 12 keys of keyed alike sets.
      a. Five master keys for each building or area grouping. Key groups include:
         1) Auditorium/Multipurpose/Stage (including adjacent support spaces).
            (a) Food Service (including Kitchen and adjacent support spaces).
            (b) Media Center (including adjacent support spaces).
            (c) Administrative Offices (including adjacent support spaces).
            (d) Classrooms, Resource Rooms and Labs (including adjacent storage area) subdivided into subgroups by floor level or building(s).
            (e) Mechanical/Electrical Rooms.
            (f) Custodial/Receiving Areas.
   2. Grand master keys shall be supplied based on size of facility as follows:
            (a) Five (5) Grandmaster keys for Elementary Schools and Ancillary Projects.
            (b) Ten (10) Grandmaster Keys for Middle Schools.
            (c) Twenty (20) Grandmaster keys for High Schools.
   3. Keys shall be stamped "DO NOT DUPLICATE".

F. Key Function
   1. Supply locksets with following key functions:
            (1) Location Function
            (b) Passage N
            (c) Privacy L
            (d) Classroom/Office R
            (e) Storage/Mechanical Rm D
            (f) Electronic Lever Lockset DEL

2.5 KEY CABINETS

A. Key Cabinet: Lund 1203 with pin tumbler lock.

B. Cabinet Size: Size for project keys plus 10% spare capacity.
   1. Horizontal metal strips for key hook labeling with clear plastic strip cover over labels.
   2. Finish: Baked enamel finish, gray color.

C. Attach key legend in key cabinet with 5-way cross-reference system indicating keyset number, FISH Room number, key code number, hook number and key description.

2.6 KEY VAULT

A. Recessed Key Vault: Knox Company, Series 4400 Know-Vault, Model 4400-R.

B. Key Vault shall be keyed to Owner's key system and will be Owner provided.

C. Manufacturer: Knox Company. Key box shall meet criteria of fire department having jurisdiction at project location.

2.7 CLOSER/MAGNETIC HOLD OPEN SYSTEM

A. LCN, Series No: 4041.

B. Furnish closer/electromagnet compete with required accessories necessary for complete working system.

C. Furnish two-year warranty.

2.8 LOCKSETS

A. Lever Lock: Best Access Lock Company, heavy duty cylindrical type, Best 93K Series, Lever Design 15D.

B. Electronic Lever Lock: Best Access Lock Company, heavy duty cylindrical type, Best 93KW7DEU, Lever Design 15D.

2.9 EXIT DEVICES

A. Von Duprin 98 Series in types and functions listed.

B. Devices shall be listed under “Panic Hardware” in accident equipment list of Underwriter Laboratories. Fire ratings shall be attached where indicated per UL requirements.

C. Exit devices shall be tested per ANSI/BHMA A156.3 by BHMA certified testing laboratory. Provide written certification of 1,000,000 cycle testing per Section 01 33 00 – Submittals.

D. Supply locksets with following key functions:
   a. Location Function
      1) Non Fire Rated 19R NLP, 19R DT, or 19R BE with 560 strike as required.
      2) Fire Rated F19R SE or F19R BE with 570 strike as required.
   2. Non Fire Rated (Pairs) 19R NLP, 19R DT, or 19R BE with 570 strike as
      (a) required.
      2) Fire Rated (Pairs) F19R SE or F19R BE with 570 strike and F4023 mullion as required.
   3. Fire Rated (Electronic) ELX98I-F X 992L X 06 X 26D.
   4. Non-fire Rated (Electronic) SD ELL X 98NL X 990NL X 06 X 26D.
   5. Power Supply PS873B X 4TD

E. Electrical Power Transfer: EPT-10 X SP28.

F. Surface strikes shall be roller type with plate underneath to prevent movement and dead- latching feature to prevent latchbolt tampering.

2.10 DOOR CLOSERS

A. Door closers shall be LCN 4040/4041 Series with non-ferrous covers, forged steel arms, separate valves for adjusting backcheck closing and latching cycles and adjustable spring to provide up to 50% increase in spring power.

B. Furnish closers with parallel arm mounted on door openings into egress spaces, mounted to permit 180 degree door swing where wall conditions permit, and have non-hold open arms unless otherwise noted.

C. Door closer cylinders shall be high strength cast iron construction.

D. Door closers shall be tested in accord with ANSI/BHMA A156.4 by BHMA certified testing laboratory and attest in writing that closers have successfully completed one million cycles.

E. Door closers shall utilize temperature stable fluid capable of withstanding temperature ranges of 120˚ F (49˚C) to -30˚F (-34˚C), without requiring seasonal adjustment of closer speed to properly close door.

F. Closers for fire rated doors shall be provided with temperature stabilizing fluid complying with UCB 7-2 (1997) and UL 10C.

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G. Door closers shall incorporate tamper resistant non-critical screw valves of V-slot design to reduce clogging form particles within closer.

H. Closers shall have separate and independent screw valve adjustments for latch speed, general speed, and hydraulic backcheck.

I. Backcheck shall be located to effectively slow swing of door at minimum of 10 degrees in advance of dead stop location to protect door frame and hardware from damage.

2.11 DOOR TRIM

A. Push/pull plates, armor plates, and kick plates shall be .050 gage stainless steel with US32D finish.

B. Plates shall be two (2”) less than door width with beveled edges, sized as follows:
   1. Push and pull plates shall be 4" wide x 16" high mounted 42” from door bottom.
   2. Armor plates shall be 36” high less than door width mounted 2” from door bottom.
   3. Kick plates 10" high x 2" less than door width mounted 2” from door bottom.

2.12 DOOR STOPS

A. Door stops shall be furnished for doors to prevent door and hardware damage. Wall bumpers are preferred. Provide floor stops where wall bumpers are not practical. Where neither wall nor floor stops are practical, use surface mounted overhead stops as follows:
   1. Wall Stops: Ives WS407CVX Series.
   2. Floor Stops: Ives FS436 or FS438.
   3. Overhead Stops: Glynn Johnson 450 Series (Interior) and 900 Series (Exterior).

2.13 THRESHOLDS, WEATHERSTRIPPING AND SEALS

A. Thresholds and weatherstripping shall be as listed in Hardware Schedule.

2.14 DOOR SILENCERS

A. Door Silencers: Ives SR64 Two (2) per door pair and three (3) per single door frame.

2.15 AUTOMATIC FLUSH BOLTS, SURFACE BOLTS AND COORDINATORS

A. Door Bolts:
   1. Manufacturer; H. B. Ives.
      (a) Non Fire-rated: 454-f26D 8”.
      (b) Fire-rated: 456-B26D.
   2. Manufacturer: Glynn Johnson:
      (a) Non Fire-rated: 1631 or 1632.
      (b) Fire-rated: FB7 or FB8.
   3. Manufacturer; DCI.
      (a) Non Fire-rated: 1008-US26D.
      (b) Fire-rated: 842-US26D.

B. Coordinators:
   1. Manufacturer: Monarch, B-1277 with B-1278 opening bar.
   2. Manufacturer: H. B. Ives, 469-B26D with 478 carry bar.
   3. Manufacturer: DCI, 500 with carry bar.

2.16 OVERHEAD RAIN DRIP

A. Rain Drip: Pemko 346PW at exterior HM Steel door locations or as scheduled herein.

PART 3 EXECUTION

3.1 INSPECTION

A. Verify that doors and frames are ready to receive work and dimensions are as indicated on shop drawings.

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B. Beginning of installation shall indicate installer’s acceptance of existing conditions.

3.2 INSTALLATION

A. Install hardware in accord with manufacturer's instructions and requirements of DHI.

B. Use templates provided by hardware item manufacturer.

C. Mounting heights for hardware from finished floor to center line of hardware item:
   1. Locksets: 38”.
   2. Push/Pulls: 42”.
   3. Dead Locks: 48”.
   4. Exit Devices: 40”.

D. Conform to Florida Bldg. Code: Accessibility, 7th Edition.

E. Set door thresholds in full bed of butyl rubber.
   1. ADJUST AND CLEAN
      a. Adjust and check operation of each item of hardware and door, to ensure proper function of every item.
      b. Replace items that cannot be adjusted to operate freely and smoothly.
      c. Final adjustment shall be made after ventilating systems are in operation.
      d. Clean hardware and adjacent surfaces after hardware installation.
      e. Instruct Owner's personnel in adjustment and maintenance of hardware and hardware finishes.

3.3 PROTECTION

   a. Protect installed hardware from damage.
   b. Replace damaged hardware.

3.4 HARDWARE SCHEDULE

A. Attached Schedule is furnished for guidance in preparing Bidder’s cost proposal and should not be considered as totally inclusive.

B. Bidders shall use drawings to prepare hardware quantities. Variations between this schedule and drawings shall be communicated to Architect for resolution.

C. Quantities listed are for each pair of doors or for each single door.

D. Hardware Schedule was prepared by:

Allegion, PLC
3451 Technological Ave, Suite 7
Orlando FL 32817
Ph: 407-571-2000
Fax 407-571-2006

END OF SECTION

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SECTION 08 71 00.1 - HARDWARE GROUP SCHEDULES

152492 OPT0485682 Version 2

Hardware Group No. 01CR

01-001 01-007 01-009.1 01-009.2 01-017 01-201

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	700 - EPT		630	IVE
2	EA	POWER TRANSFER	EPT10		689	VON
1	EA	ELEC PANIC HARDWARE	LX-RX-QEL-9847-EO 24 VDC		626	VON
1	EA	ELEC PANIC HARDWARE	LX-RX-QEL-9847-NL-OP-110MD 24 VDC		711	VON
1	EA	SFIC RIM CYLINDER	80-159		626	SCH
	EA	SFIC EVEREST CORE	80-037 EV29 R		626	SCH
2	EA	90 DEG OFFSET PULL	8190EZHD 10"		BLK	IVE
2	EA	SURFACE CLOSER	4040XP SCUSH		689	LCN
1	EA	MULTITECH READER	MT11 12 VDC		BLK	SCE
2	EA	DOOR CONTACT	679-05		WHT	SCE
1	EA	POWER SUPPLY	PS902 900-4R 120/240 VAC			VON
		Note	BALANCE OF HARDWARE BY DOOR MANUFACTURER			BYO

BALANCE OF HARDWARE BY DOOR MANUFACTURER. VERIFY HARDWARE WITH DOOR MANUFACTURERS PRODUCT APPROVALS.

Hardware Group No. 02

01-901.1 01-905

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5 NRP		630	IVE
2	EA	SURFACE BOLT	SB360 12"		604	IVE
1	EA	VANDL STOREROOM LOCK	ND96HD RHO		626	SCH
	EA	SFIC EVEREST CORE	80-037 EV29 R		626	SCH
2	EA	SURFACE CLOSER	4040XP SCUSH		689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER
1	EA	THRESHOLD	566A-223		A	ZER

FBC/NOA 12400 BASIS OF DESIGN / ASTRAGAL BY DOOR MANUFACTURER

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Hardware Group No. 03CR

01-008.2

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5 NRP		630	IVE
2	EA	POWER TRANSFER	EPT10		689	VON
1	EA	ELEC PANIC HARDWARE	LX-RX-QEL-HH-9827-EO-299F-SNB 24 VDC		626	VON
1	EA	ELEC PANIC HARDWARE	LX-RX-QEL-HH-9827-L-NL-06-299F-SNB 24 VDC		626	VON
1	EA	SFIC RIM CYLINDER	80-159		626	SCH
1	EA	SFIC EVEREST CORE	80-037 EV29 R		626	SCH
2	EA	SURFACE CLOSER	4040XP SCUSH		689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER
1	EA	MEETING STILE	328AA		AA	ZER
1	EA	THRESHOLD	566A-223		A	ZER
1	EA	MULTITECH READER	MT11 12 VDC		BLK	SCE
2	EA	DOOR CONTACT	679-05		WHT	SCE
1	EA	POWER SUPPLY	PS902 900-4R 120/240 VAC			VON

FBC/NOA 12400 BASIS OF DESIGN

Hardware Group No. 04

01-131.2 01-132.2

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		630	IVE
1	EA	PANIC HARDWARE	HH-98-L-NL-06-299F-SNB		626	VON
1	EA	SFIC RIM CYLINDER	80-159		626	SCH
1	EA	SFIC EVEREST CORE	80-037 EV29 R		626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER
1	EA	THRESHOLD	566A-223		A	ZER

FBC/NOA 12400 BASIS OF DESIGN

HB ESTIMATING REC'D 06.01.2026

Hardware Group No. 04CR

01-004.1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		630	IVE
1	EA	POWER TRANSFER	EPT10		689	VON
1	EA	ELEC PANIC HARDWARE	LX-RX-QEL-HH-98-L-NL-06-299F-SNB 24 VDC		626	VON
1	EA	SFIC RIM CYLINDER	80-159		626	SCH
1	EA	SFIC EVEREST CORE	80-037 EV29 R		626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER
1	EA	THRESHOLD	566A-223		A	ZER
1	EA	MULTITECH READER	MT11 12 VDC		BLK	SCE
1	EA	DOOR CONTACT	679-05		WHT	SCE
1	EA	POWER SUPPLY	PS902 900-4R 120/240 VAC			VON

FBC/NOA 12400 BASIS OF DESIGN

Hardware Group No. 06

01-123.2 01-124.2 01-223 01-906

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		630	IVE
1	EA	VANDL STOREROOM LOCK	ND96HD RHO		626	SCH
1	EA	SFIC EVEREST CORE	80-037 EV29 R		626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER
1	EA	THRESHOLD	566A-223		A	ZER

FBC/NOA 12400 BASIS OF DESIGN

HB ESTIMATING REC'D 06.01.2026

Hardware Group No. 07

01-101

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	224XY		628	IVE
1	EA	PANIC HARDWARE	9847-EO		626	VON
1	EA	PANIC HARDWARE	9847-NL-OP-110MD		711	VON
1	EA	SFIC RIM CYLINDER	80-159		626	SCH
	EA	SFIC EVEREST CORE	80-037 EV29 R		626	SCH
2	EA	90 DEG OFFSET PULL	8190EZHD 10"		BLK	IVE
2	EA	SURFACE CLOSER	4040XP SCUSH		689	LCN
		Note	BALANCE OF HARDWARE BY DOOR MANUFACTURER			BYO

BALANCE OF HARDWARE BY DOOR MANUFACTURER.

Hardware Group No. 08

01-005

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	REMOVABLE MULLION	KR4954 STAB		689	VON
1	EA	PANIC HARDWARE	98-EO		626	VON
1	EA	PANIC HARDWARE	98-L-06		626	VON
1	EA	SFIC RIM CYLINDER	80-159		626	SCH
1	EA	SFIC EVEREST CORE	80-037 EV29 R		626	SCH
2	EA	OH STOP	100S		630	GLY
2	EA	SURFACE CLOSER	4040XP EDA		689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
2	EA	MAGNET	SEM7800 SERIES AS REQ		689	LCN
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	MULLION SEAL	8780NBK PSA		BK	ZER
1	EA	POWER SUPPLY	PS902 900-4R-FA 120/240 VAC		LGR	SCE

Hardware Group No. 08CR

01-003

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	REMOVABLE MULLION	KR4954 STAB		689	VON
1	EA	PANIC HARDWARE	98-EO		626	VON
1	EA	ELEC FIRE EXIT HARDWARE	98-L-F-M996-06-FS		626	VON
1	EA	SFIC RIM CYLINDER	80-159		626	SCH
1	EA	SFIC EVEREST CORE	80-037 EV29 R		626	SCH
2	EA	OH STOP	100S		630	GLY
2	EA	SURFACE CLOSER	4040XP EDA		689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	MULLION SEAL	8780NBK PSA		BK	ZER
1	EA	MULTITECH READER	MT11 12 VDC		BLK	SCE
1	EA	POWER SUPPLY	PS902 900-4R-FA 120/240 VAC		LGR	SCE

Hardware Group No. 09

01-008.1 01-008.3

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	REMOVABLE MULLION	KR4954 STAB		689	VON
1	EA	FIRE EXIT HARDWARE	98-EO-F		626	VON
1	EA	FIRE EXIT HARDWARE	98-L-F-06		626	VON
1	EA	SFIC RIM CYLINDER	80-159		626	SCH
1	EA	SFIC EVEREST CORE	80-037 EV29 R		626	SCH
1	EA	OH STOP	100S		630	GLY
2	EA	SURFACE CLOSER	4040XP EDA		689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	MULLION SEAL	8780NBK PSA		BK	ZER

Hardware Group No. 10

01-908

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	AUTO FLUSH BOLT	FB31P		BLK	IVE
1	EA	DUST PROOF STRIKE	DP1/DP2		626	IVE
1	EA	STOREROOM LOCK	ND80HD RHO		626	SCH
1	EA	SFIC EVEREST CORE	80-037 EV29 R		626	SCH
1	EA	COORDINATOR	COR X FL		628	IVE
2	EA	OH STOP	100S		630	GLY
2	EA	SURFACE CLOSER	4040XP EDA		689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

Hardware Group No. 10A

01-910

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	AUTO FLUSH BOLT	FB31P		BLK	IVE
1	EA	DUST PROOF STRIKE	DP1/DP2		626	IVE
1	EA	STOREROOM LOCK	ND80HD RHO		626	SCH
1	EA	SFIC EVEREST CORE	80-037 EV29 R		626	SCH
1	EA	COORDINATOR	COR X FL		628	IVE
2	EA	SURFACE CLOSER	4040XP EDA		689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
2	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

Hardware Group No. 10B

01-901.2

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	AUTO FLUSH BOLT	FB31P		BLK	IVE
1	EA	DUST PROOF STRIKE	DP1/DP2		626	IVE
1	EA	STOREROOM LOCK	ND80HD RHO		626	SCH
1	EA	SFIC EVEREST CORE	80-037 EV29 R		626	SCH
1	EA	COORDINATOR	COR X FL		628	IVE
1	EA	OH STOP	100S		630	GLY
2	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ		689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
2	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

Hardware Group No. 12A

01-015.2

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PANIC HARDWARE	98-L-BE-06		626	VON
1	EA	SURFACE CLOSER	4040XP EDA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

Hardware Group No. 13A

01-902.1 01-902.2 01-909

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	FIRE EXIT HARDWARE	98-L-F-06		626	VON
1	EA	SFIC RIM CYLINDER	80-159		626	SCH
1	EA	SFIC EVEREST CORE	80-037 EV29 R		626	SCH
1	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4040XP EDA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

Hardware Group No. 13CR

01-101.1 01-104.2

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	POWER TRANSFER	EPT10		689	VON
1	EA	ELEC FIRE EXIT HARDWARE	98-L-F-M996-06-FS		626	VON
1	EA	SFIC RIM CYLINDER	80-159		626	SCH
1	EA	SFIC EVEREST CORE	80-037 EV29 R		626	SCH
1	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4040XP EDA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	MULTITECH READER	MT11 12 VDC		BLK	SCE
1	EA	POWER SUPPLY	PS902 900-4R 120/240 VAC			VON

Hardware Group No. 13CR.1

01-015.1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	POWER TRANSFER	EPT10		689	VON
1	EA	ELEC PANIC HARDWARE	98-L-M996-06-FS		626	VON
1	EA	SFIC RIM CYLINDER	80-159		626	SCH
1	EA	SFIC EVEREST CORE	80-037 EV29 R		626	SCH
1	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4040XP EDA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	MULTITECH READER	MT11 12 VDC		BLK	SCE
1	EA	POWER SUPPLY	PS902 900-4R 120/240 VAC			VON

Hardware Group No. 15

01-131.1 01-132.1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PANIC HARDWARE	98-L-06		626	VON
1	EA	SFIC RIM CYLINDER	80-159		626	SCH
1	EA	SFIC EVEREST CORE	80-037 EV29 R		626	SCH
1	EA	SURFACE CLOSER	4040XP EDA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

VERIFY HARDWARE COMPLYS WITH DOOR MANUFACTURERS TESTED STC GASKET SYSTEM

Hardware Group No. 16

01-119	01-122	01-123.1	01-124.1	01-125	01-126
01-131A.1	01-131A.2	01-131C	01-131E	01-132D	01-132E
01-203	01-203B	01-210	01-213	01-215	01-216
01-217	01-221				

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	WIRELESS ELECTRONIC LOCK	NDEBBDC RHO 14-042 BATTERY OPERATED		626	SCE
1	EA	SFIC EVEREST CORE	80-037 EV29 R		626	SCH
1	EA	SURFACE CLOSER	4040XP EDA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

Hardware Group No. 17

01-106C	01-122A	01-123B	01-123C	01-124B	01-124C
01-124D	01-131D	01-131F	01-131G	01-131H	01-132A
01-132B	01-132C				

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	ND80HD RHO		626	SCH
1	EA	SFIC EVEREST CORE	80-037 EV29 R		626	SCH
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

Hardware Group No. 17A

01-214

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	ND80HD RHO		626	SCH
1	EA	SFIC EVEREST CORE	80-037 EV29 R		626	SCH
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

Hardware Group No. 17B

01-131B

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	ND80HD RHO		626	SCH
1	EA	SFIC EVEREST CORE	80-037 EV29 R		626	SCH
1	EA	OH STOP	100S		630	GLY
1	EA	GASKETING	488SBK PSA		BK	ZER

HB ESTIMATING REC'D 06.01.2026

Hardware Group No. 17C

01-112 01-220 01-904

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	ND80HD RHO		626	SCH
1	EA	SFIC EVEREST CORE	80-037 EV29 R		626	SCH
1	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

Hardware Group No. 17CR

01-903 01-907

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	POWER TRANSFER	EPT10		689	VON
1	EA	EU STOREROOM LOCK	ND80HDEU RHO CON 12V/24V DC		626	SCH
1	EA	SFIC EVEREST CORE	80-037 EV29 R		626	SCH
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	MULTITECH READER	MT11 12 VDC		BLK	SCE
1	EA	POWER SUPPLY	PS902 900-4R 120/240 VAC			VON

Hardware Group No. 17D

01-113 01-123D 01-203A 01-222 01-908B

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	ND80HD RHO		626	SCH
1	EA	SFIC EVEREST CORE	80-037 EV29 R		626	SCH
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

Hardware Group No. 19

01-103	01-108.1	01-108.2	01-109	01-110	01-111
01-114	01-115	01-116	01-117.1	01-117	01-118
01-120	01-121	01-202A			

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50HD RHO		626	SCH
1	EA	SFIC EVEREST CORE	80-037 EV29 R		626	SCH
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ		689	LCN
1	EA	KICK PLATE	8400 10" X 1" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

Hardware Group No. 20

01-104	01-106A	01-106B	01-108A	01-117A	01-117B
01-119A	01-127	01-128	01-129	01-130	01-204
01-205	01-206	01-207	01-208	01-209	01-211
01-212	01-218	01-219	01-222A		

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PRIVACY LOCK W/ OUTSIDE INDICATOR	ND40S RHO OS-OCC		626	SCH
1	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4040XP EDA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

Hardware Group No. 23

01-106

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50HD RHO		626	SCH
1	EA	SFIC EVEREST CORE	80-037 EV29 R		626	SCH
1	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4040XP EDA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

Hardware Group No. 24

01-102 01-107

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50HD RHO		626	SCH
1	EA	SFIC EVEREST CORE	80-037 EV29 R		626	SCH
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

Hardware Group No. 25

01-202

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PASSAGE SET	ND10S RHO		626	SCH
2	EA	SILENCER	SR64		GRY	IVE

END OF SECTION

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SECTION 08 80 00 - GLAZING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to Glazing for:
   1. Window units.
   2. Storefront systems.
   3. Doors vision lites.
   4. Interior borrowed lites.
   5. Fire-resistive lites.
   6. Interior security glazing.

1.3 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.

B. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.

C. AAMA 800 - Specifications and Test Methods for Sealants; 2016.

D. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).

E. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

F. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2019).

G. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).

H. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008 (Reapproved 2023).

I. ASTM C1036 - Standard Specification for Flat Glass; 2025.

J. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2025.

K. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2023.

L. ASTM C1115 - Standard Specification for Dense Elastomeric Silicone Rubber Gaskets and Accessories; 2017 (Reapproved 2022).

M. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2024, with Editorial Revision (2025).

N. ASTM C1184 - Standard Specification for Structural Silicone Sealants; 2023.

O. ASTM C1281 - Standard Specification for Preformed Tape Sealants for Glazing Applications; 2016.

P. ASTM C1349 - Standard Specification for Architectural Flat Glass Clad Polycarbonate; 2017 (Reapproved 2024).

Q. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2021a.

R. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

S. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2024.

T. ASTM E1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes; 2023.

U. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2019.

V. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2025.

W. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.

X. NFPA 257 - Standard on Fire Test for Window and Glass Block Assemblies; 2022.

Y. UL 972 - Standard for Burglary Resisting Glazing Material; Current Edition, Including All Revisions.

Z. ASTM E152 – Methods for Fire Test of Door Assemblies.

AA. ASTM E163 – Methods for fire Test of Window Assemblies.

BB. ASTM E283 – Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen.

CC. ASTM E330 – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

DD. ASTM E2025 – Standard Test Method for Evaluating Fenestration Components and Assemblies for Resistance to Impact Energies.

EE. GANA – Glazing Manual.

FF. GANA – Laminated Glazing Reference Manual.

GG. FGMA – Sealant Manual.

HH. LSGA – LSGA Design Guide.

II. SGCC – Safety Glazing Certification Council.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements, for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 DEFINITIONS

A. Refer to Section 01 42 16 – Definitions, for the following terms:
   1. Glass Manufacturers.
   2. Deterioration of Laminated Glass.

1.6 SUBMITTALS

A. Refer to Section 01 30 00.0 – Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 – Product Requirements for substitution procedures.

C. Product Data: For each glass product and glazing material indicated.

D. Shop Drawings: Glazing Schedule of all openings indicating glass type, thickness, opening size and location. Schedule shall be submitted with shop drawings.

E. Glass Samples: For each type of glass product in a 12 inches (304.8 mm) square sample.

F. Glazing Accessory Samples: For sealants, in 12-inch lengths.

G. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on drawings.

H. Qualification Data: For installers, manufacturers of laminated, insulating-glass units, low-e coatings, glass testing agency and sealant testing agency.

I. Product Certificates: For glass and glazing products, from manufacturer.

J. Product Test Reports: For glass and each type of glazing sealant and gasket indicated, evidencing compliance with requirements specified.

K. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

L. Compatibility and Adhesion Test Reports: From sealant manufacturer indicating that glazing materials were tested for compatibility and adhesion with glazing sealants. Include sealant manufacturer's interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed for adhesion.

M. Compatibility Test Report: From manufacturer of insulating glass edge sealant indicating that glass edge sealants were tested for compatibility with other glazing materials including sealants, glazing tape, gaskets, setting blocks, and edge blocks.

N. Draft Warranties.

O. Exterior Product Approvals: Manufacturer shall submit documentation that product complies with large and small missile impact criteria and has been tested and approved in compliance with Florida Product Approval or Miami Dade NOA and applicable requirements.

1.7 QUALITY ASSURANCE

A. Comply with applicable codes and regulations and with the Consumer Product Safety Commission CPSC 16 CFR 1201 and with applicable recommendations of Flat Glass Marketing Association (FGMA) "Glazing Manual."

B. Manufacturer Qualifications: Provide products from only manufacturers with at least five (5) years experience making the specified materials as a current catalog and regular production item.

C. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program. Employ only experienced Contractors (installers) skilled in the successful installation of the specified materials and assemblies on similar projects for a minimum of five (5) years.

D. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

E. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

F. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
   1. GANA Publications: GANA's "Laminated Glazing Reference Manual" and GANA's "Glazing Manual."
   2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
   3. GANA Publications: "Laminated Glazing Reference Manual," and "Glazing Manual" and "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."
      a. Provide labels showing glass manufacturer's identity, type of glass, thickness, and quality. Labels shall remain on glass until it has been set.

G. All clear tempered safety glass must have permanently affixed labels for verification.

H. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or the manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, quality, and safety glazing standard with which glass complies.
   1. Safety glass must have permanently affixed labels for verification.

I. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, whether glazing is for use in fire doors or other openings, whether or not glazing passes hose-stream test, whether or not glazing has a temperature rise rating of 450 degrees Fahrenheit (232.22 degrees Celsius), and the fire-resistance rating in minutes.
   1. All fire rated glazing must have permanently affixed labels for verification.

J. Laminated-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
   1. Comply with applicable codes and regulations and with the Consumer Product Safety Commission CPSC 16 CFR 1201 and with applicable recommendations of Flat Glass Marketing Association (FGMA) "Glazing Manual."

K. Exterior Product Approvals: Manufacturer shall certify that product complies with large and small missile impact criteria and has been tested and approved in compliance with Florida Product Approval or Miami Dade NOA and applicable requirements.

1.8 PERFORMANCE REQUIREMENTS

A. General: Installed exterior glazing systems shall withstand thermal movement and wind and impact loads in compliance product approval without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. General: Installed interior glazing systems shall withstand manufacturers design parameters for thermal movement and impact loads without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain airtight; deterioration of glazing materials; or other defects in construction.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
   1. Temperature Change: 120 degrees Fahrenheit (48.89 degrees Celsius), ambient; 180 degrees Fahrenheit (82.22 degrees Celsius), material surfaces.

D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

E. Glass Design: Glass thicknesses indicated on Drawings are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites for the various size openings in the thicknesses and strengths (annealed or heat-treated) to meet or exceed the following criteria:

F. Minimum glass thickness, nominally, of lites in exterior walls is 6.0 mm 0.23 inch (5.84 mm).

G. Tinted and heat-absorbing glass thicknesses for each tint indicated are the same throughout Project.

H. Minimum glass thicknesses of lites, whether composed of annealed or heat-treated glass, are selected so the worst-case probability of failure does not exceed the following:
   1. 8 lites per 1000 for lites set vertically or not over 15 degrees off vertical and under wind action. Determine minimum thickness of monolithic annealed glass according to ASTM E1300. For other than monolithic annealed glass, determine thickness per glass

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manufacturer's standard method of analysis including applying adjustment factors to ASTM E1300 based on type of glass.
2. 1 lite per 1000 for lites set over 15 degrees off vertical and under action of wind.

I. Specific hazardous locations: The following shall be considered specific hazardous locations for purposes of glazing.
1. Glazing in ingress and means of egress doors.
2. Glazing adjacent to a door and within the same wall plane as the door whose nearest vertical edge is within 24 inches (609.6 mm) of the door in a closed position and whose bottom edge is less than 60 inches (1524 mm) above the floor or walking surface unless an intervening interior permanent wall is between the door and the glazing.
3. Glazing in fixed panels having a glazed area in excess of 9 sq feet (0.00969 sq cm) with the lowest edge less than 18 inches (457.2 mm) above the finish floor level or walking surface within 36 inches (914.4 mm) of such glazing, unless a horizontal member not less than 1-1/2 inches (38 mm) in width is located between 24 inches (609.6 mm) and 36 inches above the walking surface.

J. Impact Safety Rating: As required for the assembly in which glazing material is installed.
1. Glazing products that comply with Category I or II materials, except for hazardous and safety locations where Category II materials are required by 16 CFR 1201 and regulations of authorities having jurisdiction.
2. Glazing products shall be permanently marked with certification label of the Safety Glazing Certification Council or another certification agency or manufacturer acceptable to authorities having jurisdiction.

K. Exterior Product Approvals: Manufacturer shall certify that product complies with large and small missile impact criteria and has been tested and approved in compliance with Florida Product Approval or Miami Dade NOA and applicable requirements.

1.9 PRE-INSTALLATION CONFERENCE

A. The Contractor shall conduct a pre-installation meeting at the project site a minimum of 30 days prior to any work being installed as indicated in this section and other related sections that require coordination with this section.
1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review temporary protection requirements for glazing during and after installation.

1.10 MOCKUPS

A. Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.

B. Install glazing in mockups specified in the project manual to match glazing systems required for Project, including glazing methods.

C. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.11 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
2. Use ASTM C1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.

3. Test no fewer than eight samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
4. Schedule enough time for testing and analyzing results to prevent delaying the Work.
5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Deliver glass to site in suitable containers that will protect glass from the weather and from breakage. Carefully store material, as directed, in a safe place where breakage can be reduced to a minimum. Deliver sufficient glass to allow for normal breakage. Glazing compounds shall arrive at the project site in labeled containers which have not been opened.

B. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

C. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

D. Protect glass edges from damage during handling and installation. Damaged glass is defined as glass with edge damage or other imperfections that could weaken the glass and impair performance and/or appearance if installed. Remove damaged glass and legally dispose of offsite.

1.13 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
   1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 degrees Fahrenheit (4.44 degrees Celsius).

1.14 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
   1. Warranty Period: Five (5) years from date of Substantial Completion.

B. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form in which laminated-glass manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
   1. Warranty Period: Five (5) years from date of Substantial Completion.

C. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating- glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
   1. Warranty Period: Ten (10) years from date of Substantial Completion.

D. Manufacturer's Fire Glass Warranty: Submit manufacturer’s standard warranty but not less than five (5) years from Date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer shall be the following in each category however products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product and acceptance is provided by the Architect in writing prior to bidding.

B. Primary Glass: Provide products from one of the following:
   1. Vitro Architectural Glass (Formally PPG)
   2. Guardian
   3. OldCastle
   4. Pilkington
   5. AFGD (American Flat Glass Distributors)

C. Architectural Glass Fabricators: Provide products from one of the following:
   1. All of the above primary glass manufacturers.
   2. Globe-Amerada Glass
   3. Interpane High-Performance Glass Products
   4. Tempglass
   5. Viracon
   6. Laminated Glass Corporation
   7. Arch Amarlite

D. Plastic Interlayer Manufacturers, provide products from one of the following:
   1. DuPont, Wilmington, Delaware
   2. Saflex, St. Louis, Missouri

E. Fire Rated Glass:
   1. SAFTI FIRST
   2. Oldcastle Glass
   3. Nippon Electric Glass Co., Ltd., distributed by Technical Glass Products.

2.2 GLASS PRODUCTS

A. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
   1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

B. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
   1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

C. Refer to requirements for glass units for performance characteristics of assembled units composed of tinted glass, uncoated, relative to visible light transmittance, U-values, shading coefficient, and visible reflectance.

2.3 INTERIOR LAMINATED SECURITY GLASS (GL1)

A. Laminated Security Glass: UL 972. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
   1. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written instructions.

2. Laminated Glass products to be fabricated free of foreign substances and air or glass pockets in autoclave with heat plus pressure.
3. Laminated Security Glass:
   a. Glass Ply 1: 1/4" Clear FT
   b. Silicone and PIB: Black
   c. Interlayer: 0.090" Clear Sentry Glass Interply by Kuraray
   d. Glass Ply 2: 1/4” Clear HS

2.4 EXTERIOR GLASS TYPES (GI1)

A. Insulated Tinted Laminated Low E Coated Impact Resistant Glass for All Exterior Glazing unless noted otherwise:
   1. Insulating Tinted Laminated Low E Coated Impact Resistant Glass
   2. 1 5/16” VE3-2M insulating laminated coated glass
      a. Exterior Glass Ply: 1/4" Gray FT (Final tint color as selected by the Architect)
      b. Coating: Viracon VE-2M Low E on #2 surface
      c. Airspace: 1/2" airspace black finish
      d. Silicone and PIB: Black
      e. Interior Glass Ply 1: 1/4" Clear HS
      f. Interlayer: 0.090” Clear PVB or type of a kind and thickness as tested in a combined assembly NOA or Florida Product Approval.
      g. Interior Glass Ply 2: 1/4" Clear HS
   3. Performance Requirements
      a. Visible Light Transmittance 33%
      b. Exterior (Vis-Out) Reflectance 6%
      c. Interior (Vis-In) Reflectance 9%
      d. Winter U-Value 0.29
      e. Summer U-Value 0.26
      f. Solar Heat Gain Coefficient 0.24
      g. Light to Solar Gain Ratio 1.38

B. Insulated Tinted Laminated Low E Coated Impact Resistant Glass for All Exterior Storefront Doors, Exterior Door Lites and Side Lites,
   1. Insulating Tinted Laminated Low E Coated Hurricane Resistant Glass
   2. 1" VE3-2M insulating laminated coated glass
      a. Exterior Glass Ply: 1/4" Tinted FT (Gray) – Final tint color as selected by the Architect.
      b. Coating: Viracon VE-2M Low E on #2 surface
      c. Airspace: 5/16" airspace black finish
      d. Silicone and PIB: Black
      e. Interior Glass Ply 1: 3/16" Clear HS
      f. Interlayer: 0.090" Clear PVB or type of a kind and thickness as tested in a combined assembly NOA or Florida Product Approval. 180” Kuraray SentryGlas for Level E
      g. Interior Glass Ply 2: 3/16" Clear HS
   3. Performance Requirements
      a. Visible Light Transmittance 34%
      b. Exterior (Vis-Out) Reflectance 6%
      c. Interior (Vis-In) Reflectance 9%
      d. Winter U-Value 0.37
      e. Summer U-Value 0.38
      f. Solar Heat Gain Coefficient 0.25
      g. Light to Solar Gain Ratio 1.36

2.5 INTERIOR GLASS TYPES

A. Glass for Interior Non-Rated Doors, Sidelights, Transoms, Storefronts, and Windows:
   1. 1/4-inch thick clear tempered glass.

B. Glass for Interior Fire Rated Doors and Windows:
   1. Fire rated glazing to comply with rating requirements.

C. Glass for interior laminated security locations:
   1. 9/16-inch interior laminated security glass at indicated locations.

2.6 FIRE-RESISTIVE GLAZING PRODUCTS

A. Fire-resistive glazing products with an exposed surface film are not acceptable.

B. Fire-Protection Rating: As required for the assembly in which glazing material is installed.
   1. Glazing for Fire-Rated Door Assemblies: Glazing for assemblies that comply with NFPA 80 and that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252.
   2. Glazing for Fire-Rated Window Assemblies: Glazing for assemblies that comply with NFPA 80 and that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 257.

C. Impact Safety Rating: As required for the assembly in which glazing material is installed.
   1. Glazing products that comply with Category I or II materials, except for hazardous locations where Category II materials are required by 16 CFR 1201 and regulations of authorities having jurisdiction.
   2. Glazing products shall be permanently marked with certification label of the Safety Glazing Certification Council or another certification agency or manufacturer acceptable to authorities having jurisdiction.

D. Temperature-Rise Rating: As required for the assembly in which glazing material is installed.
   1. In exit enclosures, building codes usually require that fire-rated door assemblies have labels denoting the fire-protection rating, showing the time period, and the maximum allowed temperature-rise limit of 450 degrees Fahrenheit (232.22 degrees Celsius) on the unexposed face of the door after 30 minutes of fire exposure.
   2. When used in glazed walls, provide glazing that has a maximum transmitted temperature end point of not more than 450 degrees Fahrenheit (232.22 degrees Celsius) above ambient during standard fire-test exposure.

E. Glazing Sealants for Fire-Resistive Glazing Products: Identical to products used in test assemblies to obtain fire-protection rating.

F. Perimeter Insulation for Fire-Resistive Glazing: Identical to product used in test assembly to obtain fire-resistance rating.

G. Laminated Ceramic Glazing: Laminated glass made from 2 plies of clear, ceramic flat glass; 5/16-inch total nominal thickness; complying with testing requirements in 16 CFR 1201 for Category II materials.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Nippon Electric Glass Co., Ltd. (distributed by Technical Glass Products); FireLite Plus.
      b. Schott North America, Inc.; Laminated Pyran Crystal
      c. Vetrotech Saint-Gobain; SGG Keralite FR-L

H. Laminated Glass with Intumescent Interlayers: Laminated glass made from multiple plies of uncoated, clear tempered float glass; with intumescent interlayers; complying with testing requirements in 16 CFR 1201 for Category I materials for glass areas 9 SF or less and Category II for glass area over 9 SF.

1. Basis-of-Design: “Superlite ll-XL” as manufactured by SAFTI FIRST
2. Products: Subject to compliance with requirements, provide one of the following:
   a. InterEdge, Inc., a subsidiary of AFG Industries, Inc.; Pyrobel.
   b. Pilkington Group Limited (distributed by Technical Glass Products); PyroStop.
   c. SAFTI FIRST, a division of O’Keeffe’s, Inc.
   d. Vetrotech Saint-Gobain; SGG Contraflam N2 or SGG Swissflam N2.
3. Rating: As indicated on the drawings and as required to comply with wall and door ratings.
4. Wire glazing is not permitted.

2.7 ELASTOMERIC GLAZING SEALANTS

A. General: Provide materials as recommended by the manufacturer for the required application and condition of installation in each case. Provide only compounds which are proven to be fully compatible with surfaces contacted.

B. General:
   1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
   2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.

C. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 100/50, Use NT.

2.8 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; non-staining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:
   1. AAMA 804.3 tape, where indicated.
   2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
   3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Glazing Sealant for Fire-Resistant Glazing Products: Identical to product used in test assembly to obtain fire-resistive rating.

2.9 GLAZING GASKETS

A. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock strips, complying with ASTM C542, black.

B. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:
   1. Neoprene, ASTM C864.
   2. EPDM, ASTM C864.
   3. Silicone, ASTM C1115.
   4. Thermoplastic polyolefin rubber, ASTM C1115.

2.10 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials involved for glazing application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers and Sealers: Type recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore A durometer hardness of 85 plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side-walking).

F. Compressible Filler Rod: Shall be closed-cell or waterproof jacketed rodstock of synthetic rubber or plastic foam with proven compatibility with sealants used. Rod shall be flexible and resilient with 5-10 PSI compression strength for 25 percent deflection.

2.11 FABRICATION OF GLASS

A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with recommendations of product manufacturer and referenced glazing standard as required to comply with system performance requirements.

B. Clean cut or flat grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with indoor and outdoor faces.

C. Grind smooth and polish exposed glass edges and corners.

2.12 ENVIRONMENTAL

A. Structural Sealant: ASTM C1184, single-component neutral-curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated, and tested for use as structural sealant and approved by a structural-sealant manufacturer for use in aluminum-framed systems indicated.
   1. Provide sealants for use inside of the weatherproofing system that have a VOC content of 100 > g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Weatherseal Sealant: ASTM C920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; single-component neutral-curing formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and aluminum-framed-system manufacturers for this use.

PART 3 EXECUTION

3.1 STANDARDS AND PERFORMANCE

A. Watertight and airtight installation of each piece of glass required, except as otherwise shown. Each installation must withstand normal temperature changes, wind loading, impact loading (for operating sash and doors) without failure, including loss or breakage of glass, failure of sealants or gaskets to remain watertight and air tight, deterioration of glazing materials, and other defects in the Work.

B. Protect glass from edge damage at all times during handling, installation, and operation of the building.

C. Glazing channel dimensions as shown are intended to provide for necessary minimum bite on the glass, minimum edge clearance, and adequate sealant thicknesses with reasonable tolerances. The glazier is responsible for correct glass size for each opening within the tolerances and necessary dimensions established.

D. Comply with combined recommendations of glass manufacturer and manufacturer of sealants and other materials used in glazing and their technical representatives except where more stringent requirements are shown or specified.

E. Comply with "Glazing Manual" by Flat Glass Marketing Association and the manufacturers of the glass and glazing materials except as shown and specified otherwise.

F. Inspect each piece of glass immediately before installation and eliminate those which have observable edge damage or face imperfections.

G. Unify appearance of each series of lights by setting each piece to match others as nearly as possible. Inspect each piece and set with pattern, draw, and blow oriented in the same direction as other pieces.

3.2 EXAMINATION

A. Examine glass framing, with glazier present, for compliance with the following:
   1. Manufacturing and installation tolerances, including those for size, squareness, offsets at corners.
   2. Presence and functioning of weep system.
   3. Minimum required face or edge clearances.
   4. Effective sealing between joints of glass-framing members.

B. Do not proceed with glazing until unsatisfactory conditions have been corrected.

3.3 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings that are not firmly bonded to substrates.

3.4 GLAZING, GENERAL

A. Comply with combined recommendations of manufacturers of glass, sealants, gaskets, and other glazing materials, except where more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass from edge damage during handling and installation as follows:
   1. Use a rolling block in rotating glass units to prevent damage to glass corners. Do not impact glass with metal framing. Use suction cups to shift glass units within openings; do not raise or drift glass with a pry bar. Rotate glass lites with flares or bevels on bottom horizontal edges so edges are located at top of opening, unless otherwise indicated by manufacturer's label.
   2. Remove damaged glass from Project site and legally dispose of offsite. Damaged glass is glass with edge damage or other imperfections that, when installed, weaken glass, and impair performance and appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

D. Install elastomeric setting blocks in sill rabbets, sized and located to comply with referenced glazing standard, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass sizes larger than 50 united inches (length plus height) as follows:
   1. Locate spacers inside, outside, and directly opposite each other. Install correct size and spacing to preserve required face clearances, except where gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and comply with system performance requirements.
   2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking to comply with requirements of referenced glazing publications, unless otherwise required by glass manufacturer.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

J. Square cut wedge-shaped gaskets at corners and install gaskets in manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.5 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance during installation.

B. Secure compression gaskets in place with joints located at corners to compress gaskets producing a weather tight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

C. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel weep systems until sealants cure. Secure spacers in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass. Install pressurized gaskets to protrude slightly out of channel to eliminate dirt and moisture pockets.

3.7 LOCK-STRIP GASKET GLAZING

A. Comply with ASTM C 716 and gasket manufacturer's printed recommendations. Provide supplementary wet seal and weep system unless otherwise indicated.

3.8 PROTECTION AND CLEANING

A. Protect glass from breakage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum, alkali deposits, or stains, and remove as recommended by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both faces in each area of Project not more than four (4) days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

END OF SECTION

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SECTION 08 91 19 - FIXED LOUVERS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, materials, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Fixed louvers and frames.
   2. Screening.

1.3 REFERENCE STANDARDS

A. AAMA 611 - Specification for Anodized Architectural Aluminum; 2026.

B. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; 2023.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

E. ASTM A167 – Stainless and Heat-Resisting Chromium-Nickel Steel Plate.

F. ASTM B209 – Aluminum Alloy Sheet and Plate.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 – Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 – Product Requirements for substitution procedures.

C. Product Data: Each type of product specified shall bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

D. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
   1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
   2. Show mullion profiles and locations.

E. Samples: For each type of metal finish required.

F. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.

G. Exterior Product Approvals: Manufacturer shall submit documentation that product complies with large and small missile impact criteria and has been tested and approved in compliance with Florida Product Approval or Miami Dade NOA and applicable requirements.

1.6 QUALITY ASSURANCE

A. Perform work in accordance with AMCA Certification for louvers.

B. Manufacturer's Qualifications: Provide products from a firm that makes the indicated products as a regular production item and with not less than ten (10) years experience.

C. Exterior Product Approvals: Manufacturer shall certify that product complies with large and small missile impact criteria and has been tested and approved in compliance with Florida Product Approval or Miami Dade NOA and applicable requirements.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

B. Coordinate work with installation of wall assembly.

C. Coordinate work with installation of mechanical ductwork.

1.8 WARRANTY

A. Provide 10-year warranty as specified.

B. Warranty: Include coverage for degradation of finish.

1.9 PERFORMANCE REQUIREMENTS

A. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
   1. Temperature Change (Range): 80 degrees Fahrenheit (26.67 degrees Celsius), ambient; 120 degrees Fahrenheit (48.89 degrees Celsius), material surfaces.

C. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

D. Exterior Product Approvals: Manufacturer shall certify that product complies with large and small missile impact criteria and has been tested and approved in compliance with Florida Product Approval or Miami Dade NOA and applicable requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
   1. Greenheck Fan Company.

B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
   1. Airolite Company
   2. Ruskin Company.

2.2 LOUVERS

A. Wall Louvers:
   1. Basis of Design Product: Florida NOA: Refer to the "Approved Products" table on drawings for Florida Product Approval and/or NOA numbers.
      a. "EHV-550D" Aluminum wind-driven rain louver.
   2. Provide fasteners for louver installation into wall material per the product approval.
   3. Provide brake metal sill flashing with finish to match louver, turn inside edge up 1/2 inch (12.7 mm) to for lip at back of louver and location 1/2 inch away from louver.

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4. Provide brake metal trim at jambs and head to accommodate conditions and finish all edges of opening for louver.

2.3 LOUVER SCREENS

A. General: Provide screen at each exterior louver.
   1. Screen Location for Fixed Louvers: Interior face.
   2. Screening Type: Bird and insect screening.

B. Secure screen frames to louver frames with machine screws with heads finished to match louver, spaced a maximum of 6 inches (152.4 mm) from each corner and at 12 inches (304.8 mm) o.c.

C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
   1. Metal: Same type and form of metal as indicated for louver to which screens are attached. Reinforce screen frames at corners with clips.
   2. Finish: Mill finish unless otherwise indicated.
   3. Type: Rewirable frames with a driven spline or insert.

2.4 BLANK-OFF PANELS

A. Uninsulated, Blank-Off Panels: Metal sheet attached to back of louver.
   1. Blank-off sheet for aluminum louvers, not less than 0.050-inch nominal thickness minimum.
   2. Panel Finish: Same finish type applied to louvers, but black color.
   3. Attach blank-off panels with sheet metal screws.

2.5 ACCESSORIES

A. Fasteners: Use types and sizes to suit unit installation conditions from 300 series stainless steel.
   1. For color-finished louvers, use fasteners with heads that match color of louvers.

B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

C. Flashings: Of same material as louver frame.

D. Sealants: Type specified in specification section – Joint Sealants.

2.6 MATERIALS

A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5, T-52, or T6.

B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

2.7 FABRICATION

A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Maintain equal louver blade spacing to produce uniform appearance.

C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

D. Include supports, anchorages, and accessories required for complete assembly.

E. Provide mullions of type and at spacings indicated, but not more than is recommended by manufacturer.

F. Exterior Corners: Prefabricated corner units with mitered and welded corners.

G. Provide sub-sills made of same material as louvers. Roll formed or extruded to required shape, single length in one piece per location.

H. Join frame members to each other and to fixed louver blades with fillet welds concealed from view unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

I. Screens: Install a screen mesh in a shaped frame, with reinforce corner construction, and shop installed to louver with fasteners.

J. Design and fabricate louver to prevent entry of wind driven rain into the building. Provide louver, which traps rain and diverts water back to the exterior and not into the building or the wall cavity.

K. Sleeve:
1. Fabricate an aluminum 12-gauge sleeve around entire perimeter of louvered opening, 16” in horizontal depth, with a 1 1/2” perimeter flange at the exterior perimeter, with an upturned flange along the back of the sleeve, so there is at least 2" between the bottom of the ductwork and the bottom of the sleeve.
2. The sleeve is to serve as a pan to collect wind driven rainwater back to the exterior of the building envelope.
3. Seal all louvers to wall penetrations through the sleeve.
4. Also seal both the exterior and interior perimeter of the sleeve.
5. Connect and seal to ductwork as required.

2.8 FINISHES

A. Aluminum Surfaces: Sections shall be free of scratches and other serious surface blemishes and chemically cleaned.

B. Aluminum Surfaces: Comply with NAAMM’s “Metal Finishes Manual for Architectural and Metal Products” for recommendations for applying and designating finishes. Sections shall be free of scratches and other serious surface blemishes and chemically cleaned.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

E. Clear Anodic Finish: Class 1, Mechanical Finish, nonspecular as fabricated Chemical Finish, etched Anodic Coating, clear coating 0.7mils or thicker complying with AAMA 612. Complying with paint manufacturer's written instructions for cleaning, preparing, pretreating and apply coating to exposed metal surfaces.

F. Final finishes of exterior aluminum surfaces, screens, and blank-out sheeting as selected by Architect.

G. Interior aluminum surfaces, screens, and blank-out sheeting shall be of mill finished.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Verify that prepared openings, flashings and ductwork are ready to receive work and opening dimensions are as indicated on shop drawings.

3.2 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Protect unpainted galvanized and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

F. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with specification section "Joint Sealants" for sealants applied during louver installation.

G. Install flashings and align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.

H. Secure louvers in opening framing with concealed fasteners, removable and hinged for maintenance purposes.

I. Install insect screens and frame to intake louvers.

J. Install bird screens to exhaust louvers.

K. Install perimeter sealant and backing rod in accordance with specification section – Joint Sealants.

3.4 ADJUSTING AND CLEANING

A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

C. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

END OF SECTION

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SECTION 09 05 61 - COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specification and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES:

A. This section applies to floors identified in Contract Documents that are receiving the following types of floor coverings:

1.3 REFERENCE STANDARDS

A. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation; 2014 (Reaffirmed 2024).

B. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 50 mm [2 in.] Cube Specimens); 2024.

C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.

D. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

1.4 DEFINITIONS

A. Refer to Section 01 42 16 - Definitions for the following terms:
   1. Adhesives.
   2. Leadership in Energy and Environmental Design (LEED).
   3. Volitile Organic Compound (VOC).

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

1.6 SUBMITTALS

A. Refer to Section 01 30 00.0 – Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 – Product Requirements for substitution procedures.

C. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
   1. Moisture and alkalinity (pH) limits and test methods.
   2. Manufacturer's required bond/compatibility test procedure.

D. Adhesive Bond and Compatibility Test Report.

E. Floor Moisture Testing Technician Certificate: International Concrete Repair Institute (ICRI) Concrete Slab Moisture Testing Technician- Grade I certificate.

1.7 PERFORMANCE REQUIREMENTS

A. Refer to the following for specific sub-flooring and finish flooring requirements:
   1. Section 03 30 00 - Cast-In-Place Concrete.
   2. Section 03 54 00 - Cast Underlayment.

1.8 QUALITY ASSURANCE

A. Construction Manager may perform adhesive and bond test with Construction Manager's own personnel or hire a testing agency.

B. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.
   1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.
   2. Acceptable Testing Agencies:
      a. Other testing agency approved by Owner.
      b. Substitutions: Not permitted.

C. Floor Moisture Testing Technician Qualifications: International Concrete Repair Institute (ICRI) Concrete Slab Moisture Testing Technician Certification- Grade I.

D. Remedial Coating Installer Qualifications: Company specializing in performing work of the type specified in this section, trained by or employed by coating manufacturer, and able to provide at least 3 project references showing at least 3 years' experience installing moisture emission coatings.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle, and protect products in accordance with manufacturer’s instructions and recommendations.

B. Deliver materials in manufacturer’s packaging; include installation instructions.

C. Keep materials from freezing.

1.10 FIELD CONDITIONS

A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F (18 degrees C) or more than 85 degrees F (30 degrees C).

B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

1.11 WARRANTY

A. Provide Flooring Adhesive Manufacturer’s:
   1. Delamination Warranty that there shall be no delamination failure:
      a. Due to adhesive failure for a period of five (5) years from date of installation when applied to adhere approved flooring materials per Adhesive manufacturer’s requirements.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Specifications are based on the products identified as Basis of Design. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years’ experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.

B. Substitutions: Refer to Section 01 25 13.0 - Substitution Procedures.

2.2 MATERIALS

A. Patching Compund: Refer to Section 03 54 00 - Cast Underlayment

B. Alternate Flooring Adhesive: Floor covering manufacturer's recommended product, suitable for the moisture and pH conditions present; low-VOC. In the absence of any recommendation from flooring manufacturer, provide a product recommended by adhesive manufacturer as suitable for substrate and floor covering and for conditions present.

C. Spray-Applied Adhesive:
   1. Water-based pressure-sensitive aerosol adhesive, VOC- Free, non-flammable, and non-HAP, emitting no dangerous fumes or odors.

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2. Manufacturers:
   a. Spray-Lock by Interlock Industries, Inc., (706) 517-8989.

D. Remedial Floor Sheet Membrane: Pre-formed multi-ply sheet membrane installed over concrete subfloor and intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.
   1. Thickness: 28 mil (0.028 inch) (0.711 mm).
   2. Tape: Types recommended by underlayment manufacturer to install membrane and cover seams.
   3. Basis of Design:

PART 3 EXECUTION

3.1 REMOVAL OF EXISTING FLOOR COVERINGS

A. Refer to Section 02 41 00 - Demolition.

3.2 CONCRETE SLAB PREPARATION

A. Follow recommendations of testing agency.

B. Perform following operations in the order indicated:
   1. Existing concrete slabs (on-grade and elevated) with existing floor coverings:
      a. Visual observation of existing floor covering, for adhesion, water damage, alkaline deposits, and other defects.
      b. Removal of existing floor covering in accordance with Section 02 41 00 - Demolition.
   2. Existing concrete slabs with coatings or penetrating sealers/hardeners/dustproofers:
      a. Do not attempt to remove coating or penetrating material.
      b. Do not abrade surface.
   3. Preliminary cleaning.
   4. Moisture vapor emission tests; 3 tests in the first 1000 square feet (100 square meters) and one test in each additional 1000 square feet (100 square meters), unless otherwise indicated or required by flooring manufacturer.
   5. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
   6. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
   7. Specified remediation, if required.
   8. Patching, smoothing, and leveling, as required.
   9. Other preparation specified.
   10. Adhesive bond and compatibility test.
   11. Protection.

C. Remediations:
   1. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.
   2. Excessive Moisture Emission or Relative Humidity: If an adhesive that is resistant to the level of moisture present is available and acceptable to flooring manufacturer, use that adhesive for installation of the flooring; if not, apply remedial floor coating or remedial sheet membrane over entire suspect floor area.
   3. Excessive Alkalinity (pH): If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; if not, if an adhesive that is resistant to the level present is available and acceptable to the flooring manufacturer, use that adhesive for installation of the flooring; otherwise, apply a skim coat of specified patching compound over entire suspect floor area.

3.3 PRELIMINARY CLEANING

A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.

B. Do not use solvents or other chemicals for cleaning.

3.4 MOISTURE VAPOR EMISSION TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.

C. Test in accordance with ASTM F1869 and as follows.

D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.

E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet (1.4 kg per 93 square meters) per 24 hours.

F. Report: Report the information required by the test method.

3.5 PREPARATION

A. Refer to individual floor covering section(s) for additional requirements.

B. Comply with recommendations of testing agency.

C. Comply with requirements and recommendations of floor covering manufacturer.

D. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.

E. Do not fill expansion joints, isolation joints, or other moving joints.

3.6 ADHESIVE BOND AND COMPATIBILITY TESTING

A. Comply with requirements and recommendations of floor covering manufacturer.

3.7 APPLICATION OF REMEDIAL FLOOR COATING

A. Comply with requirements and recommendations of coating manufacturer.

3.8 INSTALLATION OF REMEDIAL FLOOR SHEET MEMBRANE

A. Install in accordance with sheet membrane manufacturer's instructions.

3.9 APPLICATION OF SPRAY-APPLIED ADHESIVE

A. Installation per each floor finish assembly product manufacturer’s written instructions, and as follows:
   1. Spray-Applied Adhesive Method:
      a. Do not place finish-flooring product until adhesive applied to substrate is ready to receive it per adhesive manufacturer’s instructions.
      b. Mark floor equivalent to manufacturer’s recommended area for size of container used. Apply no more or less adhesive than what manufacturer recommends.
      c. Outline perimeter of the room with a 4-5 inch (100-125 mm) wide band of adhesive. Apply the adhesive from 8-12 inches (200-300 mm) above the substrate.
      d. Lay flooring finish material, adjust and reset until layout placement is certain.
      e. Following installation of finish flooring (typically within an hour after installing) roll entire floor area with a 75 to 100 lb (34 to 45 kg) roller to ensure proper bonding with instant shear strength.

2. Close space to traffic for 2 hours before beginning installation, however, flooring is immediately available after rolling for all range of use.

3.10 PROTECTION

A. Cover prepared floors with building paper or other durable covering.

END OF SECTION

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SECTION 09 21 16 - GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specification and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Steel framing systems.

B. Suspension systems for ceilings, soffits, and grid systems.

C. Acoustic insulation.

D. Cementitious backer board.

E. Gypsum Board.

F. Joint treatment.

G. Accessories.

1.3 REFERENCE STANDARDS

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2020).

B. AISI S201 - North American Standard for Cold-Formed Steel Framing - Product Data; 2017.

C. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing; 2020.

D. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing; 2020.

E. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2023.

F. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 2023.

G. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

I. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2025.

J. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2025.

K. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017 (Reapproved 2022).

L. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2024.

M. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.

N. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2025.

O. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2022.

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P. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.

Q. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020 (Reapproved 2024).

R. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.

S. ASTM C1278/C1278M - Standard Specification for Fiber-Reinforced Gypsum Panel; 2017.

T. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units; 2022, with Editorial Revision (2023).

U. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.

V. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels; 2024.

W. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.

X. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

Y. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2026.

Z. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems; 2024.

AA. GA-216 - Application and Finishing of Gypsum Panel Products; 2024.

BB. GA-600 - Fire Resistance and Sound Control Design Manual; 2024.

CC. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

DD. UL (FRD) - Fire Resistance Directory; Current Edition.

EE. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

FF. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of gypsum board assemblies with size, location, and installation of service utilities.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

C. Sequencing: Install service utilities in an orderly and expeditious manner.

1.6 SUBMITTALS

A. Refer to Section 01 30 00.0 - Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 – Product Requirements for substitution procedures.

C. Product Data:
   1. Include data substantiating that materials comply with specified requirements.

2. Provide data on metal framing, gypsum board, accessories, and joint finishing system, describing standard framing member materials and finish, product criteria, load charts, and limitations..
3. Describe methods and provide details for securing studs to tracks, deflection tracks, splicing, and for blocking and reinforcing for studs which were cut or modified for piping and conduit penetrations.
4. Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

D. Shop Drawings: Indicate special details associated with fireproofing.

E. Samples:
1. Gypsum Board: Submit two samples of gypsum board finished with proposed texture application, 12 by 12 inches (300 by 300 mm) in size, indicating finish color and texture.
2. Trim Accessories: Full-size Sample in 12-inch length for each trim accessory indicated.

F. Steel Framing Industry Association (SFIA) Certification:
1. Submit documentation that metal studs and connectors used on project meet or exceed requirements of International Building Code.
2. Provide certification in accordance with "Code Compliance Certification Program for Cold-Formed Steel Structural and Non- Structural Framing Members."
3. Submit current documentation of contractor and fabricator accreditation. Keep copies of each on-site during and after installation, and present upon request.

G. Test Reports: For stud framing products that do not comply with AISI S220 or ASTM C754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.

H. Evaluation Service Reports:
1. Show compliance of grid suspension systems with specified requirements.
2. For embossed steel studs and runners and firestop tracks, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

I. SSMA Manufacturer Qualification: Submit documentation of manufacturer association membership.

J. Installer's Qualification Statement.

K. Submit documentation verifying materials and components are from single manufacturer.

L. Submit manufacturer’s storage and product installation instructions. Indicate special procedures, perimeter conditions requiring special attention.

1.7 QUALITY ASSURANCE

A. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in Florida.

B. SFIA Code Compliance Certification Program: www.CFSteel.org/#sle: Use metal studs and connectors certified for compliance with International Building Code.

C. Manufacturer Qualifications: Member of Steel Framing Industry Association (SFIA).

D. Manufacturer Qualifications: Member of Steel Stud Manufacturers Association (SSMA): www.ssma.com.

E. Professional Installer and Fabricator Qualifications: SFIA-accredited contractor and fabricator: www.CFSteel.org.

F. Installer Qualifications: Company specializing in performing work of the type specified and with at least five (5) consecutive years of documented installation experience of specified products of similar and equivalent work scope.

G. Provide full time quality control over fabrication and erection complying with applicable codes and regulations of government agencies having jurisdiction.

H. Prior to and during installation, coordinate with work of other trades to facilities required openings and finishes.

I. Documents at Project Site: Maintain at the project site a copy of manufacturer's instructions.

1.8 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies:
   1. For fire-resistance-rated assemblies that incorporate non- load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E119 by an independent testing agency.
   2. Fire-rated Assemblies: Listed and rated by Underwriter's Laboratories, Inc. or generic fire resistance ratings listed in GA-600.
   3. Fire-Hazard Classification: Listed and labeled by Underwriter's Laboratories, Inc.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

C. Design steel in accord with American Iron and Steel Institute Publication "Specification for the Design of Cold-Formed Steel Structural Members", except as otherwise shown or specified.

D. Design loads: 5 PSF minimum design lateral load is required for interior walls by building code.

E. Framing systems for interior non-load bearing walls shall withstand design loads for lateral deflections less than L/240.

F. Framing system to accommodate deflection of primary building structure and construction tolerances.

G. Framing shall conform to load charts and limitations and shall be designed to accommodate special loading conditions such as point loads, eccentric loads, etc.

H. Mold Resistant Assemblies: Provide materials and construction identical to those tested according to ASTM D3273 and achieving a mold resistance score of 10.

I. Perform gypsum board systems work in accordance with recommendations of ASTM C754, C840, and GA-216 except as otherwise specified in this section.

1.9 PREINSTALLATION MEETINGS

A. Conduct pre-installation meeting at the project site a minimum of 30 days prior to any work being installed as indicated in this section and other related sections that require coordination with this section.

B. Meeting participants to include the following: drywall contractor, Architect, Owner, Construction Manager, and others involved with process.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

B. Protect gypsum products from weather exposure; Store gypsum products and accessories indoors under cover.
   1. Keep dry and protect against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage.
   2. Stack panels flat and supported on risers on a flat platform to prevent sagging. Elevate boards above floor, on nonwicking supports, in accordance with manufacturer's recommendations.
   3. Keep room temperature above freezing.

C. Protect metal products from exposure to moisture; Store metal products to prevent corrosion.

D. Notify manufacturer of damaged materials received prior to installing.

PART 2 PRODUCTS

2.1 GYPSUM BOARD ASSEMBLIES

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
   1. Metal Framing:
      a. MBA Metal Framing: www.mbastuds.com
      b. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
         1) ClarkDietrich: www.clarkdietrich.com
         2) Marino\WARE, a division of Ware Industries, Inc.: www.marinoware.com
         3) MBA Metal Framing: www.mbastuds.com
         4) The Steel Network (TSN): https://steelnetwork.com
   2. Grid Suspension System:
      a. Armstrong World Industries: www.armstrongceilings.com
      b. Rockfon North America (Chicago Metallic Corporation): www.rockfon.com/en-us
      c. USG Corporation: www.usg.com
   3. Gypsum-Based Board:
      a. USG Corporation: www.usg.com
      b. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
         1) CertainTeed Corporation: www.certainteed.com
         2) Georgia-Pacific Gypsum: www.gpgypsum.com
         3) National Gypsum Company: www.nationalgypsum.com
   4. Cementitious Backer Board:
      a. USG Corporation: www.usg.com
      b. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
         1) Custom Building Products: www.custombuildingproducts.com
   5. Trim Accessories:
      a. USG Corporation: www.usg.com
      b. ClarkDietrich: www.clarkdietrich.com
      c. Marino\WARE, a division of Ware Industries, Inc.: www.marinoware.com

B. Provide completed assemblies complying with ASTM C840 and GA-216.

C. Wall Types: As indicated on Drawings.

D. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

E. Fire-Resistance-Rated Assemblies: Provide completed assemblies with the following characteristics:
   1. Fire-Resistance-Rated Partitions: UL listed assembly No. U415A; one hour rating.
   2. Fire-Resistance-Rated Partitions: UL listed assembly No. _____; two hour rating.
   3. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

2.2 METAL FRAMING MATERIALS

A. Material and Product Requirements: AISI S201 and AISI S220.

B. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S220 or equivalent.
   1. Structural Grade: As required to meet design criteria.
   2. Corrosion Protection Coating Designation: G40, or equivalent in accordance with AISI S220.

C. Comply with ASTM C 754 for conditions indicated.

D. Steel Sheet Components: Comply with ASTM C 645 requirements for metal and as otherwise indicated.

E. Protective Coating: ASTM A 653/A 653M.

F. Studs and Runners: Use either steel studs and runners or dimpled steel studs and runners.

G. Steel Studs and Runners:
   1. Minimum Base-Metal Thickness: 20-gauge or manufacturer's equivalent and as indicated otherwise.
   2. Depth: 3-5/8", 6" and as indicated otherwise.
   3. Punch Outs: 12" from base and every 48" thereafter.
   4. Stud Angle Bracing: 2 1/2".

H. Nonstructural Framing System Components: AISI S220; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf (L/120 at 240 Pa).
   1. Studs: C-shaped with knurled or embossed faces.
   2. Minimum Base Metal Thickness: Same thickness as steel studs and runners.
   3. Depth: 1-5/8", 3-5/8", 6" and as indicated on drawings.
   4. Runners:
      a. U shaped.
      b. J shaped.
      c. Depth: Sized to match studs.
      d. Thickness: Same thickness as steel studs.
      e. Ceiling Runners:
         1) Depth: 3-5/8", 6" and as indicated on Drawings, or larger as required to support ceiling/soffit design load.
   5. Ceiling Channels:
      a. Shape: As indicated on Drawings.
      b. Depth: As indicated on Drawings.
   6. Furring Members - Hat-Shaped, Rigid Furring Channels:
      a. Depth: 7/8 inch (22 mm)minimum.
      b. Minimum Base-Metal Thickness: 25-gauge and as indicated on drawings.
      c. Size: 2-9/16" wide x 7/8" high, or as indicated on drawings.
   7. Furring Members - Zee-shaped sections:
      a. Non-slotted web with 3/4" wall attachment flange.
      b. Thickness: 25-gauge or manufacturer's equivalent and as indicated on Drawings.
      c. Depth: 1, 1-1/2", and 2-1/2" and as indicated on drawings.

I. Shaft Wall Studs and Accessories: Galvanized sheet steel.

J. Partition Head To Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and screwed to secondary deflection channel set inside but unattached to top track.

K. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection and prevent rotation of studs while maintaining structural performance of partition.
   1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100.

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2. Material: ASTM A653/A653M steel sheet, SS Grade 50 (340), with G60 (Z180) hot-dip galvanized coating.
3. Provide components UL-listed for use in UL-listed fire-resistance-rated head of partition joint systems indicated on drawings.
4. Provide mechanical anchorage devices as described above that accommodate deflection while maintaining the fire-resistance rating of the wall assembly.
5. Provide top track preassembled with connection devices spaced to fit stud spacing indicated on drawings; minimum track length of 12 feet (3660 mm).

L. Deflection Track; Slip-Type Head Joint:
1. Steel sheet double long leg top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above.
2. Basis of Design Products:
   a. “MaxTrak Slotted Deflection Track” as manufactured by Clark Dietrich Building Systems.
   b. “Flat Steel Deflection Track” as manufactured by MBA Building Supplies.
   c. “VertiClip SLD Series” as manufactured by Steel Network, Inc.
3. Thickness: Not less than indicated for studs.
4. Width: Accommodate depth of studs.

M. Nonstructural Framing Accessories:
1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
2. Partial Height Wall Framing Support: Provides stud reinforcement and anchored connection to floor.
   a. Material: ASTM A653/A653M steel sheet with factory-welded steel plate base.
      1) Height: As indicated on Drawings.
   b. Materials: ASTM A1011/A1011M sheet steel support member with factory-welded ASTM A36/A36M steel plate base.
      1) Height: 23-5/8 inches (600.1 mm).
3. Flat Strap and Backing Plate:
   a. Steel sheet for blocking and bracing in length and width indicated.
   b. Base-Metal Thickness: 16-gauge minimum, and as indicated on drawings.
   c. Width: 4 inches.
4. Cold-Rolled Channel Bridging:
   a. Base-Metal Thickness: 16-gauge minimum, and as indicated on drawings.
   b. Depth: 1/2 inch.
   c. Width: 1-1/2 inch.
5. Framing Connectors - Clip Angles for securing cold-rolled channel to wall studs for lateral bracing:
   a. Comply with ASTM A653/A653M, G90 (Z275)
   b. Material: Galvanized steel.
   c. Size: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch thick, galvanized steel.
6. Isolation Strip at Exterior Walls:
   a. Provide 15# asphaltic impregnated felt.
7. Drywall Corner Clips: Drywall clips help support drywall to reduce wood blocking on top plates, end walls, and corners.
8. Steel Column and Beam Drywall Clip: UL-listed slip-on clips to connect gypsum board to steel beams and columns for fireproofing.

N. Grid Suspension Systems: Steel grid system of main tees and support bars connected to structure using hanging wire.
1. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch diameter wire, or double strand of 0.048-inch diameter wire.
2. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.

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3. Carrying Channels: Cold-rolled, 1 1/2" deep commercial-steel sheet with a base-metal thickness of 16-gauge with 1/2-inch wide flanges.
4. Cold-Rolled Channels: 16-gauge uncoated-steel thickness, with minimum 1/2-inch wide flanges, 3/4 inch deep.
5. Hat-Shaped, Rigid Furring Channels: 7/8 inch deep minimum base-metal thickness of 25-gauge and as indicated on drawings.
6. Suspension Systems for Exterior Soffits and Ceilings:
   a. Basis of Design Product: "Stucco/Plaster Grid System" as manufactured by Armstrong World Industries.
   b. Direct-hung grid suspension system composed of the main beams and cross tee members that interlock to form a modular supporting system, provide uplift restraints to comply with wind load design requirements.
7. Suspension Systems for Interior Gypsum Board Ceilings:
   a. Basis of Design Product: "Drywall Grid System"
   b. Direct-hung grid suspension system composed of the main beams and cross furring members, that interlock to form a modular supporting system.
   c. Conform to ASTM C645 - Standard Specification for Nonstructural Steel Framing Members.

O. Hanger Attachments to Concrete:
1. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488/E 488M conducted by a qualified testing agency.
2. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.

2.3 BOARD MATERIALS

A. Gypsum Board: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
2. Abuse resistant gypsum panels, as defined in ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels.
3. Unfaced fiber-reinforced gypsum panels, as defined in ASTM C1278/C1278M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board.
4. Fire-resistant Gypsum Board (GWB):
   a. Basis of Design Product: “Firecode Core Type X”
   b. Core: 5/8 inch, Type X.
   c. Long Edges: Tapered.
5. Moisture-Mold-Resistant Gypsum Board (AGWB):
   a. Basis of Design Product: “Mold Tough Firecode Type X”
   b. Core: 5/8 inch, Type X.
   c. Long Edges: Tapered.
   d. Core and paper surfaces: Moisture and mold-resistant.
   e. Score of 10, when tested in accordance with ASTM D3273.
   f. Mold-resistant board is required whenever board is being installed before the building is enclosed and conditioned.
   g. Mold resistant board is required at restrooms and custodial locations.
6. Abuse Resistant Gypsum Board (GWB):
   a. Basis of Design: “Mold Tough AR Firecode Core Type X”

b. Abuse resistant with heavy abrasion and mold/mildew/moisture resistant paper face.
c. Core: 5/8", Type X.
d. Long Edges: Tapered.
e. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

7. Thickness:
a. As indicated on Drawings.

B. Cementitious Backer Board:
1. Basis of Design Product: "Durock® Brand Cement Board with EdgeGuard™" cementitious fiber-mat reinforced sheathing.
2. Application:
a. Surfaces behind tile in wet areas.
b. Exterior soffits.
3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
4. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement slurry panels with polymer-coated, glass-fiber mesh embedded in edges, front, and back surfaces.
5. Comply with ASTM C1325 for nonasbestos - Standard Specification for for nonasbestos Fiber-Mat Reinforced Cementitious Backer Units.
6. Thickness: As indicated on Drawings.
7. Edges:
a. Edge: Manufacturers standard.

C. Interior Ceiling Board (GCX): Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Ceilings, unless otherwise indicated.
2. Thickness: As indicated on Drawings.
3. Edges: Tapered.

D. Shaftwall and Coreboard: Type X; 1 inch (25 mm) thick by 24 inches (600 mm) wide, beveled long edges, ends square cut.
1. Paper-Faced Type: Gypsum shaftliner board or gypsum coreboard as defined ASTM C1396/C1396M; water-resistant faces.

2.4 GYPSUM BOARD ACCESSORIES

A. General:
1. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
2. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

B. Soffit Vent: 4" wide continuous by depth to match soffit material depth with double leg channels mounting channels where indicated.

C. Spot Grout: ASTM C475, setting type joint compound recommended for spot grouting hollow metal door frames.

D. Asphalt Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), non-perforated.

E. Acoustic Insulation: Glass-Fiber Acoustical Blanket Insulation.
1. Conform to ASTM C665 - Standard Specification for Mineral-Fiber Blanket, Type 1.
2. Test Standards:ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials:
a. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials:
1) Flame-spread Index: Less than 25.
2) Smoke-developed Index: Less than 50.
b. Passes ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C:

3. Material: Preformed mineral-fiber, friction fit type.
4. Facing: Unfaced.
5. Thickness: 3 1/2" and 6" thick and as indicated on Drawings.
6. Sound Transmission Class (STC): As indicated on Drawings.
7. Install in stud walls and other locations as indicated on Drawings.

F. Joint Tapes:
   1. Gypsum Board Tape:
      a. Comply with ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
      b. Interior Paper-Faced Gypsum Board: Paper.
      c. Paper Tape: 2 inch (50 mm) wide, with center crease, and buffed on both sides, for joints and corners. Comply with ASTM C475.
   2. Cementitious Board Tape:
      a. As recommended by panel manufacturer.
   3. Gypsum board sheathing Tape:
      a. 2” wide 10 x 10 glass mesh quick tape or equivalent.
   4. Sound Isolation Tape:
      a. Elastomeric foam tape for sound decoupling.
      b. Surface Burning Characteristics: Provide assemblies with flame spread index of 75 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
      c. Tape Thickness: 1/4 inch (6 mm).
      d. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
         1) Armacell LLC: www.armacell.us/#sle.

G. Adhesive for adhering gypsum board to masonry and concrete:
   1. As recommended by gypsum board manufacturer.

H. Sealants and Caulk:
   1. Gypsum board sheathing:
      a. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
         1) Sealant Basis of Design Products:
            (a) "DOWSIL™ 795 Silicone Building Sealant" as manufactured by Dow.
            (b) "Pecora 895 NST" Silicone sealant with non-staining technology (NST) as manufactured by Pecora Corporation.
         2) Caulk:
            (a) Siliconized acrylic latex caulk:
               (1) Non-sag.
               (2) Paintable.
               (3) Mildew and water resistant.
               (4) Suitable for indoor and outdoor use.
   2. Acoustic Sealant:
      a. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product,

and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
1) "Powerhouse Siliconized Acrylic Latex Sealant" as manufactured by Sherwin Williams.
2) "AC-20 FTR" as manufactured by Pecora Corporation.
3) "SHEETROCK Acoustical Sealant" as manufactured by USG Corporation,

b. Acrylic emulsion latex or water-based elastomeric sealant:
1) Non-sag.
2) Paintable.
3) Non-staining.
4) Reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
5) Flame spread and smoke developed rating: Less than 25 per ASTM E84.

c. Comply with ASTM C834 - Standard Specification for Latex Sealants.
d. Do not use solvent-based non-curing butyl sealant.
e. Acoustical Sealant for Concealed Joints for sealing interior concealed joints to reduce transmission of airborne sound:
1) Composed of synthetic rubber.
2) Non-drying, non-hardening.
3) Non-skinning.
4) Non-staining.
5) Gunnable.

I. Beads, Joint Accessories, and Other Trim: ASTM C1047, galvanized steel, unless noted otherwise.
1. Material: Steel sheet zinc coated by hot-dip or electrolytic process, or steel sheet coated with aluminum or rolled zinc, 26-gauge minimum comply with ASDTM A653.
2. Corner Beads:
a. Shapes: Low profile, for 90 degree outside corners.
1) LC-Bead: J-shaped; exposed long flange receivers joint compound.
2) L-Bead: L-shaped: exposed long flange receives joint compound.
3) U-Bead: J-shaped; exposed short flange does not receive joint compound.
4) Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

3. Trim:
a. Provide trims in 10 foots lengths.

J. Joint Compounds:
1. Joint Compound for Interior Gypsum Board:
a. For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
b. Prefilling, Open Joints, and Damaged Areas: Use setting-type taping compound.
c. Embedding and First Coat: For embedding tape and first coat on joints, fasteners and trim flanges, use drying-type, all-purpose compound.
1) Use setting-type compound for installing paper-faced metal trim accessories.

d. Fill Coat: For second coat, use drying-type, all-purpose compound.
e. Finish Coat: For third coat, ready mix drying-type, all-purpose compound.
f. Embedding, Fill and Finish Coat: For embedding mesh and finish coats on joints, fasteners, and trim flanges, use quick set compound without cellulous content.
g. Finish: Match existing adjacent.

2. Joint Compound for Exterior Applications:

a. As recommended by cementitious backer unit manufacturer.

3. Joint Compound for Tile Backing Panels:
   a. Cementitious Backer Units: As recommended by backer unit manufacturer.

K. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
   1. Self-drilling, self-tapping screws; complying with ASTM C1513-13 - Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections.

L. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches (0.84 mm) in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.
   1. Screws for Gypsum Board (ASTM C1002): Phillips head galvanized steel Type self-drilling screws, length and type as required and recommended by gypsum board manufacturer.
      a. Type S-12, Bugle head, self-tapping, rust-resistant, fine tread for heavy gauge steel.
      b. Type S, bugle head, rust resistant, sharp point, and fine thread for light gauge steel or furring.

2.5 FINISHES

A. Framing Materials:
   1. Galvanizing shall conform to with ASTM A 653
   2. Galvanized to G40 for interior materials.
   3. Galvanized to G60 for exterior materials.
   4. Galvanized to G60 for interior materials in contact with cementitious materials or other materials that could induce corrosive actions.

B. Hangers, Anchors, and Fastening Devices: Galvanized.
   1. Galvanized to G40 for interior materials.
   2. Galvanized to G60 for exterior materials.
   3. Galvanized to G60 for interior materials in contact with cementitious materials or other materials that could induce corrosive actions.

C. Touchup Paint:
   1. Comply with ASTM A780/A780M-09 (2015): Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

B. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

C. Examine boards before installation. Reject boards that are wet, moisture damaged, and mold damaged.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

B. Protect adjacent surfaces from drywall compound.

C. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

D. Coordination with Sprayed Fire-Resistive Materials:
   1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
   2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire- resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

E. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

F. Do not install gypsum panels that are wet, moisture damaged, and mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

3.3 SHAFT WALL INSTALLATION

A. Shaft Wall Framing: Install in accordance with manufacturer's installation instructions.
   1. Fasten runners to structure with short leg to finished side, using appropriate power-driven fasteners at not more than 24 inches (600 mm) on center.
   2. Install studs at spacing required to meet performance requirements.

B. Shaft Wall Liner: Cut panels to accurate dimensions and install sequentially between special friction studs.
   1. On walls over sixteen feet high, screw-attach studs to runners top and bottom.
   2. Seal perimeter of shaft wall and penetrations with acoustical sealant.

3.4 FRAMING INSTALLATION

A. Install in accordance with ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products, and manufacturer's instructions.
   1. Also comply with requirements in ASTM C840 that apply to framing installation.
   2. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, wall cabinets or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

E. Floor track shall be bedded in two (2) beads of continuous acoustical sealant at all sound rated partitions.

F. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
   1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
   2. Tile backing panels: 16 inches o.c., unless otherwise indicated.

G. Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

H. Where studs or stud clips are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

I. Install studs so flanges within framing system point in same direction.

J. Install horizontal bridging not more than 48 inches apart in walls where the height of the studs require additional bracing and where wall cabinets are to be installed.

K. Install horizontal bridging in the unbraced area where studs extend above the top of gypsum wall board to the roof or floor deck above in excess of 48”. If the distance between the deck and the top of gypsum wall board in the unbraced area exceeds 48”, then horizontal bridging shall be added at 48” o.c. in the unbraced area.

L. Install horizontal bridging not more than 48 inches apart in walls where sheathing is only applied to one side.

M. Install deep leg or slip head track wherever wall extends to underside of roof or floor structure and provide space for structural deflection. Install one row of horizontal bridging parallel to and within 12 inches of head track. Do not attach studs to head track.

N. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.

O. Fire-Resistance-Rated Partitions:
   1. Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
   2. Wire tie furring channels to supports.

P. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

Q. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
   1. Level ceiling system to a tolerance of 1/1200.
   2. Laterally brace entire suspension system.
   3. Install bracing as required at exterior locations to resist wind uplift.
   4. Stud Supported Ceiling: Space studs at 16 inches on center, or as required to meet design loads.
   5. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types:
      a. Hangers: 48 inches on center.
      b. Carrying Channels (Main Runners): 48 inches on center.
      c. Furring Channels (Furring Members): 16 inches on center.
   6. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
   7. Suspend hangers from building structure as follows:
      a. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
         1) Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, counter-splaying, or other equally effective means.
      b. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
         1) Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
      c. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
      d. Do not attach hangers to steel roof deck.
      e. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.

f. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
g. Do not connect or suspend steel framing from ducts, pipes, or conduit.
h. Grid Suspension Systems:
1) Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces.
2) Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
3) Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

R. Studs: Space studs at 16 inches on center (at 406 mm on center).
1. Extend partition framing to structure where indicated and to ceiling in other locations.
2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.

S. Openings:
1. Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
a. Install two studs at each jamb unless otherwise indicated.
b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

T. Furring:
1. Standard Wall Furring: Install at concrete walls scheduled to receive gypsum board, not more than 4 inches (100 mm) from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches (600 mm) on center.
a. Orientation: Horizontal.
b. Spacing: As indicated.
2. Direct Furring: Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 16 inches o.c.
3. Furring for Fire-Resistance Ratings: Install as required for fire-resistance ratings indicated and to GA-600 requirements.
4. Z-Furring Members:
a. Apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
b. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 16 inches o.c.
c. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.
5. Acoustic Furring: Install resilient channels at maximum 24 inches (600 mm) on center. Locate joints over framing members.

U. Resilient Sound Isolation Clips: Install resilient sound isolation clips, and where applicable, associated furring sections and channels, in accordance with clip manufacturer's written instructions.

V. Blocking: Install wood blocking for support of:
   1. Framed openings.
   2. Wall-mounted cabinets.
   3. Plumbing fixtures.
   4. Toilet partitions.
   5. Toilet accessories.
   6. Wall-mounted door hardware.

3.5 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustical Insulation:
   1. Install acoustical blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.
   2. Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Sound Isolation Tape: Apply to vertical studs and top and bottom tracks/runners in accordance with manufacturer's instructions.

C. Acoustic Sealant: Install in accordance with manufacturer's instructions.
   1. Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations.
   2. Comply with ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications, and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
   3. Place one bead continuously on substrate before installation of perimeter framing members.
   4. Place continuous bead at perimeter of each layer of gypsum board.
   5. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

D. Acoustical Shielding: Install in accordance with manufacturer's instructions for application between studs and gypsum board.

E. Sound Barrier Mullion Trim Cap Installation: Install in accordance with manufacturer's instructions for installation of fire-rated mullion trim caps.

3.6 PANEL INSTALLATION

A. Comply with ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board, or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Spot grout fill interior metal frames in gypsum board partitions with gypsum board compound at hinge and strike locations.
   1. Fully fill interior frames with gypsum board compound at Music and Mechanical room walls.

C. Install panels with face side out.

D. On partition walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated, or required by fire-resistance-rated assembly. Minimize end joints.
   1. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.

E. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4 to 3/8 inch wide joints to install sealant.

F. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments.
1. Provide 1/4 to 1/2 inch wide spaces at these locations and trim edges with edge trim where edges of panels are exposed.
2. Seal joints between edges and abutting structural surfaces with acoustical sealant.

G. Hold gypsum board 1/2 inches off of floor.
1. Bottom of all gypsum board panels to slab shall receive a continuous bead of sealant with a smooth finish aligned with the finished face of the gypsum board.

H. Single-Layer, Nonrated:
1. Single-Layer Nonrated: Install gypsum board as indicated on Wall Type description, with ends and edges occurring over firm bearing.
a. Exception: Tapered edges to receive joint treatment at right angles to framing.

I. Double-Layer, Nonrated:
1. Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing.
2. Place second layer perpendicular to framing or furring members.
a. Offset joints of second layer from joints of first layer.

J. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

K. Exposed Gypsum Board in Interior Wet Areas:
1. Seal joints, cut edges, and holes with water-resistant sealant.

L. Cementitious Board:
1. Install over steel framing members where indicated.
2. Interior walls, Tile Backing Panels:
a. Comply with ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units, and manufacturer's instructions.
b. Comply with manufacturer's written installation instructions and install at locations indicated to receive tile. Install with 1/4 inch gap where panels abut other construction or penetrations. Apply joint tape over gypsum board joints and finish with compound per manufacturer’s instructions.
c. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.
3. Exterior Soffits:
a. Install exterior soffit board perpendicular to framing, with staggered end joints over framing members or other solid backing.
b. Seal joints, cut edges, and holes with water-resistant sealant.

M. Ceiling suspension systems:
1. Apply gypsum panels on ceilings before wall partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.
3. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

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N. Installation on Metal Framing:
   1. Use steel drill screws for attachment of gypsum board on metal framing, except face layer of nonrated double-layer assemblies, which may be installed by means of adhesive lamination.
   2. Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

3.7 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated on drawings.
   1. Not more than 30 feet (10 meters) apart on walls and ceilings over 50 feet (16 meters) long.
   2. At exterior soffits, not more than 30 feet (10 meters) apart in both directions.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.
   1. For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

D. Moisture Guard Trim: Install on bottom edge of gypsum board throughout building.

E. Exterior Soffit Vents: Install according to manufacturer's written instructions and in locations indicated on drawings. Provide vent area specified.

3.8 JOINT TREATMENT

A. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

B. Install to minimize butt end joints, especially in highly visible locations.

C. Form control and expansion joints with space between edges of adjoining gypsum panels.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints.

E. Do not place tapered edges against cut edges or ends.

F. Stagger abutting end joints not less than one framing member in alternate courses of panels. Stagger vertical joints on opposite sides of partitions.

G. Double-Layer panel joint locations: Offset joints of second layer from joints of first layer.

H. Do not make joints other than control joints at corners of framed openings.

I. Control Joints; Provide control joints in gypsum board partitions, bulkheads, ceilings, and soffits as follows:
   1. Partition, furring, or column fireproofing abuts a structural element (except floor) or dissimilar wall or ceiling.
   2. Ceiling or soffit abuts a structural element, dissimilar wall or partition or other vertical penetration.
   3. Construction changes within plane of partition or ceiling.
   4. Partition or furring run exceeds 40 feet, unless noted otherwise.
   5. Ceilings with perimeter relief when dimensions exceed 50 feet in either direction.
   6. Ceilings without perimeter relief when dimensions exceed 30 feet in either direction.
   7. Soffits that exceed 30 feet in length.
   8. Exterior soffits exceed 30 feet in either direction.
   9. Wings of “L”, “U”, and “T”-shaped ceiling areas are joined.
   10. Ceiling between two ends of walls.
   11. Top corners of both sides of recessed door entries.
   12. Expansion or control joints occur in the exterior wall.

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13. Less than ceiling height frames should have control joints extending to the ceiling from both corners. Ceiling height door frames may be used as control joints. Treat window openings in same manner as doors.
14. USG Control Joint No. 093: Apply over face of gypsum board where specified. Cut to length with a fine-toothed hacksaw (32 teeth per inch). Cut end joints square, butt together, and align to provide neat fit. Attach control joint to gypsum board with fasteners spaced 6 inches o.c. maximum along each flange. Remove plastic tape after finishing with joint compound or veneer finish.
    a. Leave a 1/2 inch continuous opening between gypsum boards for insertion of surface-mounted joint.
    b. Interrupt wood floor and ceiling plates with a 1/2 inch gap, wherever there is a control joint in the structure.
    c. Do not attach gypsum board to steel studs on one side of control joint.
    d. Provide separate supports for each control joint flange.
    e. Provide an adequate seal behind control joint where sound or fire ratings are prime considerations.

J. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.9 FINISHING GYPSUM BOARD ASSEMBLIES

A. General:
1. Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for finish.
2. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels; Finish panels to levels indicated below and according to ASTM C 840:
1. Level 0: No taping, finishing, or accessories required.
    a. This level of finish shall be used in temporary construction only.
2. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
    a. Joints and interior angles shall have tape embedded in joint compound. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable. This finish level shall be used in plenum areas above ceilings, in attics, in areas where the assembly is concealed.
3. Level 2: Tile backing panels.
    a. Joints and interior angles shall have tape embedded in joint compound, and one separate coat of joint compound applied over joints, angles, fastener heads, and accessories. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable. This finish level shall be used where water resistant gypsum backing board (ASTM C630) is used as a substrate for tile only.
4. Level 3: Mechanical, Electrical Rooms, Storage Rooms, and where indicated.
    a. Joints and interior angles shall have tape embedded in joint compound, and two separate coats of joint compound applied over joints, angles, fastener heads, and accessories. Joint compound shall be smooth and free of tool marks and ridges. Note: It is recommended that the prepared surface be coated with a primer/sealer prior to the application of final finishes. See painting/wall covering specification in this regard. This final level shall be used in areas that are to receive heavy textured, thick (1/8 inch or greater) wall coverings.
5. Level 4: All other spaces unless indicated otherwise.

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a. Joints and interior angles shall have tape embedded in joint compound, and three separate coats of joint compound applied over joints, angles, fastener heads, and accessories. Joint compound shall be smooth and free of tool marks and ridges. Note: Prepare surface to be coated with a primer/sealer prior to the application of final finishes. This finish level shall be used where textured finishes, wall coverings, and painted (flat or eggshell) finishes are to be applied.

6. Level 5: None.
   a. Joints and interior angles shall have tape embedded in joint compound and three separate coats of joint compound applied over joints, angles, fastener heads, and accessories. A thin skim coat of joint compound, or a material manufactured especially for this purpose, shall be applied to the entire surface. The surface shall be smooth and free of tool marks and ridges. Note: Prepare surface to be coated with a primer/sealer prior to the application of finish paint. This finish level shall be used with semi-gloss or gloss painted finishes.

E. Use the following joint compound combination as applicable to the finish levels specified:
   1. Embedding and First Coat: Setting type joint compound. Fill (Second) Coat: Setting type joint compound. Finish (Third) Coat: Ready mixed, drying type, all purpose or topping compound.

F. Provide Fire Rated/Smoke Barrier partition labeling as per signage specifications.

3.10 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

D. Protect installed gypsum board assemblies from subsequent construction operations.

3.11 WASTE MANAGEMENT

A. Collect cutoffs and scrap and place in designated areas for recycling.

B. Coordinate with manufacturer and local recycler for take-back program or recycling. Set aside scrap to be returned to manufacturer for recycling into new product.

END OF SECTION

SECTION 09 24 00 - CEMENT PLASTERING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Exterior portland cement plasterwork.
      a. Cement plaster soffit (PSD).

1.3 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

B. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2019 (Reapproved 2025).

C. ASTM C35 - Standard Specification for Inorganic Aggregates for Use in Gypsum Plaster; 2001 (Reapproved 2019).

D. ASTM C206 - Standard Specification for Finishing Hydrated Lime; 2014 (Reapproved 2022).

E. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2024.

F. ASTM C473 - Standard Test Methods for Physical Testing of Gypsum Panel Products; 2024.

G. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.

H. ASTM C847 - Standard Specification for Metal Lath; 2018 (Reapproved 2024).

I. ASTM C897 - Standard Specification for Aggregate for Job-Mixed Portland Cement-Based Plasters; 2025.

J. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).

K. ASTM C926 - Standard Specification for Application of Portland Cement-Based Plaster; 2024.

L. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2022.

M. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.

N. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020 (Reapproved 2024).

O. ASTM C1063 - Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster; 2025a.

P. ASTM D1784 - Standard Classification System and Basis for Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds; 2025.

Q. ASTM E72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction; 2022.

R. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2026.

S. GA-600 - Fire Resistance and Sound Control Design Manual; 2024.

T. ASTM C91 – Standard Specification for Masonry Cement.

U. ASTM C150 – Standard Specification for Portland Cement.

V. ASTM C1177 – Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

W. ASTM E96 – Standard Test Methods for Water Vapor Transmission of Materials.

X. PCA (Portland Cement Association) – Plaster (Stucco) Manual.

Y. ML/SFA (Metal Lath / Steel Framing Association)–Specifications for Metal Lathing and Furring.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements, for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 – Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 – Product Requirements for substitution procedures.

C. Product Data: For each type of product indicated submit copies of manufacturer' product specifications and installation instructions and other data as may be required to show compliance with these specifications.

D. Shop Drawings: Show locations and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other work.

E. Samples: For each type of finish coat indicated; 12 by 12 inches (305 by 305 mm), and prepared on rigid backing.

1.6 QUALITY ASSURANCE

A. Cement Plaster: Perform work in accordance with ASTM C926.

B. Allowable Tolerances: For flat surfaces, do not exceed 1/8" to 10'-0" for bow, warp, plumb, or level.

C. Applicator shall show proof of specializing in lath and plaster work for a minimum of five (5) years.

1.7 MOCK-UP

A. Mock-ups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

B. Build mock-ups for each substrate and finish texture indicated for cement plastering, including accessories.

C. Size: 100 sq. ft. in surface area.

D. Approval of mock-ups does not constitute approval of deviations from the Contract Documents contained in mock-ups unless Architect specifically approves such deviations in writing.

E. Subject to compliance with requirements, approved mock-ups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 PRE-INSTALLATION MEETINGS

A. The Contractor shall conduct a pre-installation meeting at the project site a minimum of 30 days prior to any work being installed as indicated in this section and other related sections that require coordination with this section.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

B. Installation of rusted furring members is not acceptable.

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1.10 FIELD CONDITIONS

A. Exterior Plasterwork:
   1. Apply and cure plaster to prevent plaster drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
   2. Apply plaster when ambient temperature is greater than 40 degrees Fahrenheit (4.44 degrees Celsius).
   3. Protect plaster coats from freezing for not less than 48 hours after set of plaster coat has occurred.

1.11 PERFORMANCE REQUIREMENTS

A. Fabricate vertical elements to limit finish surface to 1/240 deflection under lateral point load of 100 lbs.

B. Fabricate horizontal elements to limit finish surface to 1/240 deflection under superimposed dead loads and wind uplift loads.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
   1. ClarkDietrich Building Systems

B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
   1. Nile Building Products Co.
   2. MarinoWare
   3. Amico, A Gibraltar Industries Co.
   4. Alabama Metal Industries
   5. Steel Network, Inc.
   6. MBA Building Supplies

2.2 FURRING MATERIALS

A. Channels shall be fabricated from galvanized 16-gauge cold rolled steel, free of rust of the following minimum weight per thousand lineal feet.
   1. 3/4 inch (19.05 mm) furring channels: 16-gauge, 300 pound minimum L.F.
   2. 1-1/2 inch (38 mm) carrying channels: 16-gauge, 500 pound minimum L.F.

B. Tie and hanger wire to be of galvanized, soft annealed steel or of a material and size having superior corrosion resistance and equivalent strength to the wire specified.
   1. Tie wire: 16-gauge
   2. Hanger wire: 8-gauge

C. Hangers: Steel, of size and type to suit application, rigidly support-ceiling components in place, and meet deflection limits as indicated.

D. Lateral Bracing: Formed steel; minimum 16-ga thick; size and length as required.

2.3 GLASS-MAT GYPSUM SHEATHING

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.

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1. Georgia Pacific Gypsum, LLC.
   a. Basis of Design Product: “DensGlas Sheathing Type X”

B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
   1. National Gypsum Company
   2. CertainTeed Corporation

C. Material: Fiberglass-Mat faced gypsum sheathing for exterior use.

D. Comply with ASTM C1117/117M, Type X.

E. Thickness: 5/8 inch (15.88 mm).

F. Width: 4 feet (121.92 cm).

G. Length: 8 feet (243.84 cm).

H. Edges: Square.

I. Surfacing: Fiberglass mat on face, back and long edges

2.4 PLASTER MATERIALS

A. Portland Cement: ASTM C 150, Type I.

B. Lime: ASTM C207, Type S.

C. Perlite Aggregate: ASTM C35.

D. Aggregate: Natural or manufactured sand, complying with ASTM C926.

E. Ready-Mixed Plaster: Mill-mixed portland cement, aggregates, and proprietary ingredients.

2.5 TRIM ACCESSORIES

A. General: Comply with ASTM C1063, and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.

B. Plastic Accessories
   1. Provide high impact polyvinylchloride (PVC) conforming to ASTM D1784, Type II, D4216.
   2. Thickness: 0.050-inch minimum.
   3. Color: Off-white.
   4. Size: 10-foot lengths.
   5. Cornerbeads: With perforated flanges.
      a. Smallnose cornerbead; use unless otherwise indicated.
   6. Casing Beads: With perforated flanges in depth required to suit plaster bases indicated and flange length required to suit applications indicated.
      a. Square-edge style; use unless otherwise indicated.
   7. Control Joints Type “V”: One-piece-type, folded pair of unperforated screeds in V-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
   8. Expansion Joints: Two-piece type, formed to produce slip-joint and square-edged 1/2-inch wide reveal; with perforated concealed flanges.
   9. Connectors
      a. Connector Clips: Polyvinylchloride (PVC) plastic clips for aligning continuous lengths of molding.
      b. Notch-Lok Connections: Polyvinylchloride back plates for aligning intersecting lengths of moldings.
      c. "+" and "T" Intersections: Factory fabricated intersections used to connect horizontal and vertical joints of moldings.
   10. Soffit Vent: 4" wide continuous by depth to match soffit material depth with double leg channels mounting channels verify with the Architect.

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11. Weep Screed: One-piece weep screed with 3 1/2" mounting flange with “V” shaped bottom element with drainage holes.
12. Manufacturers are as indicated however equal or better performing products of other manufacturers will be considered for acceptance by the Architect.
    a. Plastic Components, Inc.
    b. Vinyl Corp.
    c. Amico, A Gibraltar Industries Co.

2.6 MISCELLANEOUS MATERIALS

A. Water for Mixing: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.

B. Fiber for Base Coat: Alkaline-resistant glass or polypropylene fibers, 1/2 inch (12.7 mm) long, free of contaminants, manufactured for use in portland cement plaster.

C. Bonding Agent:
1. Manufacturer(s) and basis of design for products shall be one of the following. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
    a. "ThoroseallAcryl 60," as manufactured by Harris Specialty Chemicals, Inc.
    b. "Bonsal Acrylic Additive" as manufactured by W.R. Bonsal Company.
    c. "Silkalatex," as manufactured by Sika Chemical Corporation.
2. Conform to ASTM C1059.
3. Exterior applications and areas exposed to water immersion or to high humidity: A non re-emulsifiable acrylic emulsion. To be used as integrally mixed product when recommended by the Portland stucco system manufacturer.

D. Waterproofing: Formulated stearate compound for increasing the water repellency.
1. Manufacturer(s) and basis of design for products shall be one of the following. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
    a. “Hydrocel” as manufactured by Lambert Corporation.
    b. “Omicron Mortar proofing” as manufactured by Master Builders.
    c. “Hydratite” as manufactured by A. C. Horn.

E. Admixture:
1. Manufacturer(s) and basis of design for product shall be the following. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
    a. “Acrylic 60” Acrylic-polymer emulsion, as manufactured by Thoroseral.

F. Steel Drill Screws: For metal-to-metal fastening, ASTM C1002 or ASTM C954, as required by thickness of metal being fastened; with pan head that is suitable for application; in lengths required to achieve penetration through joined materials of no fewer than three exposed threads.

G. Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch diameter unless otherwise indicated.

H. Underlayment: Glass-reinforced 15# asphaltic impregnated felt complying with ASTM D6757.

2.7 LATHING MATERIALS

A. General: Lath shall be manufactured to meet ASTM C847 with ASTM A653/A653M, G60 hot-dip galvanized zinc coating.

B. Diamond-Mesh Lath: Self-furring diamond mesh with dimples or raised ribs, G-60 zinc galvanized and weighing not less than 3.4 pounds per sq. yd.

C. Paper Backed Metal Lath: Self-furring diamond mesh with dimples or raised ribs, G-60 zinc galvanized and weighing not less than 3.4 pounds per sq. yd. and with asphalt-impregnated paper backing. Grade B, Style 1a, vapor-retardant paper.

D. Fasteners for Attaching Metal Lath to Substrates: Complying with ASTM C 1063.

E. Glass Fiber Mesh: Shall be Type 207A, Perma Tite glass mesh 10 by 10 construction, white resin coated, conforming to ASTM D1668, Type III, self-adhering. Acceptable manufacturer: Perma Glass Mesh Corporation, Dover, Ohio.

F. Corner Mesh: Formed sheet steel; minimum 26-ga thick; expanded flanges shaped to permit complete embedding in plaster; minimum 4" size.

G. Strip Mesh: Expanded metal lath, minimum 26-ga thick 4" wide x 24" long.

2.8 PLASTER MIXES

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
   1. Basis of Design Product: “Master Builders” as manufactured by BASF.
   2. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
      a. Quickrete Company
      b. Titan Florida LCC

B. General: Comply with ASTM C 926 for applications indicated.

C. Exterior Cement Plaster for Use over Metal Lath:
   1. Scratch Coat: Pre-blended mixture of portland cement, reinforcing fibers and manufacturer's additional ingredients “Stucco Base”.
   2. Brown Coat: Pre-blended mixture of portland cement, reinforcing fibers and manufacturer's additional ingredients “Stucco Base”.
   3. Finish Coat: Waterproofing cement-based coating “MasterSeal - Waterproof Cement Based Coating #584”.
   4. Admixture: Water based acrylic bonding and modifying admixture which shall be added to all coats “Acryl 60”.
   5. Total vertical system thickness: 7/8”
   6. Total horizontal system thickness: 3/4"

D. Exterior Cement Plaster for Use over Masonry and Concrete:
   1. First Coat: Waterproofing cement-based coating “MasterSeal - Waterproof Cement Based Coating #584”.
   2. Finish Coat: Pre-blended mixture of portland cement, reinforcing fibers and manufacturers additional ingredients “Stucco Base.”
   3. Admixture: Water based acrylic bonding and modifying admixture which shall be added to all coats “Acryl 60”.
   4. Total system thickness: 5/8”

2.9 FINISHES

A. Framing Materials:

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1. Galvanized to G60 for exterior materials.
2. Galvanized to G60 for materials in contact with other materials.

B. Hangers, Anchors, and Fastening Devices:
1. Galvanized to G60 for exterior materials.
2. Galvanized to G60 for materials in contact with other materials.

C. Stucco: As selected by the Architect.

D. Cement Plaster Soffit (PSD): Float finish.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Before plaster is applied, the surfaces to be plastered shall be carefully examined by the subcontractor. The Architect and General Contractor shall be notified of unsatisfactory surfaces or conditions. Application of stucco shall not proceed until unsatisfactory conditions have been corrected.
1. Concrete: Verify joints are cut flush and surface is ready to receive Work. Verify no bituminous, water repellent coatings, or form release agents are on concrete surfaces to receive stucco finish.
2. Concealed Supports, Blocking: Verify items have been installed in proper locations.
3. Mechanical and Electrical: Verify services within walls and soffits have been installed, tested, and approved.

D. Examine substrates to which gypsum board assemblies attach or abut, installed hollow metal frames, and structural framing with Installer present for compliance with requirements for installation tolerances and other conditions affecting performance of assemblies specified in this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.

B. Prepare solid substrates for plaster that are smooth or that do not have the suction capability required to bond with plaster according to ASTM C926.

C. Protect surfaces near stucco application from damage or disfiguration. Clean concrete surfaces of foreign matter. Thoroughly dampen surfaces before using acid solutions, solvent, or detergents to perform cleaning. Wash surfaces with clean water. Do not apply stucco until electrician has protected all boxes. Cover openings in wall, column, and soffit with wire lath prior to stuccoing. Secure covering for openings greater than 16 inches (406.4 mm) in their least dimension to properly anchored channels or other support. Conceal all piping, conduit, etc. which cannot be concealed in walls, columns or soffits with wire lath and stucco. Verify all surfaces to receive stucco are true and plumb. Chip back concrete as required and replace masonry where necessary to avoid thickness greater than indicated for finished systems. Patch all masonry joints and honeycombing in cast-in-place concrete to provide flush, true surfaces to receive stucco. Pressure clean all surfaces with pressurized water with machine providing a minimum of 3,500 p.s.i. with a turbo-nozzle capable of developing sufficient force to remove all foreign matter from masonry surfaces. Abrade all cast-in-place concrete surfaces to receive stucco to promote mechanical bond. On exterior masonry and concrete surfaces install temporary grounds and screeds as necessary to strike off stucco to true surfaces. No permanent corner beads, fabricated control joints, grounds or screeds shall be used on exterior

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masonry and poured concrete surfaces. On wire lath and interior applications, install corner beads, control joints, expansion joints and accessories indicated on drawings true and plumb using maximum lengths available. Anchor securely to substrate. Do not shim or bridge areas that are not plumb, true, or straight.

D. Exterior Surfaces
   1. Dampen exterior surfaces prior to the application of plaster and maintain in a moist condition throughout the course of application.

3.3 CEILING AND SOFFIT FRAMING

A. Install furring to height indicated, erect after above ceiling or soffit work is complete.
   1. Coordinate the location of hangers with other work.

B. Suspension System: Install 1-1/2 inch (38 mm) carrying channels at maximum spacing of 4 feet (121.92 cm) o.c. and 3/4 inch (19.05 mm) furring channels at maximum spacing of 16 inches (406.4 mm) o.c.

C. Metal Lath: Install lath with lapped and broken joints and well secured to adjoining work. Lath to be folded around corners and angles 8 inches (203.2 mm) each way. Attach lath to furring at 6 inches (152.4 mm)o.c. for ceilings and bulkheads. Install self-furring metal lath to concrete and masonry surfaces with fastener type and spacing as recommended by lath manufacturer.

D. Metal Studs: Install studs where indicated on the Drawings or where required for framing of bulkheads or ceilings.

E. Install furring independent of walls, columns, and above ceiling work.

F. Provide uplift restraint studs at 4'-0" o.c. in each direct at exterior soffits.

G. Securely anchor hangers to structural members or embed in structural slab.
   1. Space hangers to achieve deflection limits indicated.

H. Securely fix carrying channels to hangers, prevent turning/twisting and transmit full load to hangers.

I. Place furring channels perpendicular to carrying channels, not more than 2" from perimeter walls, and rigidly secure.
   1. Lap the splices securely.

J. Reinforce openings in suspension system that interrupt main carrying channels or furring channels with lateral channel bracing.
   1. Extend bracing minimum 24" past each opening.

K. Laterally brace suspension system.

L. Install plaster frames for recessed light fixtures furnished by electrical contractor under this section.

3.4 GLASS MAT SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.
   1. Fasten gypsum sheathing to cold-formed metal framing with screws.
   2. Install panels with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
   3. Install panels with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.

C. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.
   1. Space fasteners approximately 8 inches (203.2 mm) o.c. and set back a minimum of 3/8 inch (9.52 mm) from edges and ends of panels.

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2. For sheathing under stucco cladding, panels may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

D. Seal sheathing joints according to sheathing manufacturer's written instructions.
   1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
   2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

3.5 INSTALLING METAL LATH

A. Metal Lath: Install according to ASTM C1063.
   1. Partition Framing and Vertical Furring: Install self-furring-diamond-mesh lath.
   2. Flat-Ceiling and Horizontal Framing: Install self-furring-diamond-mesh lath.
   3. Exterior Soffits and Areas areas with Vapor Barriers: Install paper backed lath.
   4. Exterior walls with drainage mat: Install self-furring-diamond-mesh lath with 15# felt slip sheet.

B. Lathing Materials: Apply one (1) ply of felt underlayment over substrate, weatherlap edges four (4) inches minimum. Fasten in place. Apply metal lath taut, with long dimension perpendicular to supports. Lap ends minimum one (1) inch. Secure end laps with tie wire where they occur between supports. Lap sides of diamond mesh lath together minimum 1-1/2 inches (38 mm). Nest outside ribs of rib lath together. Continuously reinforce interior angles with corner mesh except where metal lath returns three (3) inches from corner to form the angle reinforcement, fasten at perimeter edges only. Place strip mesh diagonally at corners of lathed openings. Secure rigidly in place. Where dissimilar materials abut, and surfaces are to receive a continuous application of stucco, provide a continuous 8" wide strip of galvanized wire lath, lapping 4" to either side of joint. EXCEPTION: where cast-in-place concrete has been poured on or against masonry, the joints do not require reinforcing.

C. Self-Furring Metal Lath: Lap one inch and tie at 6-inch vertical spacing.

D. Moisture Retention, Curing
   1. Dampen previous stucco coats which have dried out prior to time for applications of next coat. Dampen with water as required for uniform suction. The Contractor is responsible for determining the most effective procedure for curing and time lapse between application of coats based on climatic and job conditions. Plaster which is cracked or crazed due to improper timing and curing will not be accepted. Remove and replace defective plaster, including plaster base materials if damaged during removal of defective plaster.

E. Portland Cement Plaster Stucco Lathing and Furring Installation Standard: Install lathing, furring materials indicated for Portland cement plaster to comply with ANSI A42.3.

F. Install supplementary framing, blocking, and bracing at terminations in work, for support of fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, similar work to comply with details indicated, or if not otherwise indicated, to comply with applicable published recommendations of equipment manufacturers.

G. Where lathing and metal support system abuts building structure horizontally, where partition/wall work abuts overhead structure, isolate the work from structural movement sufficiently to prevent transfer of loading onto work from building structure. Install slip or cushion type joints to absorb deflections but maintain lateral support.
   1. Frame both sides of expansion joints independently; do not bridge joints with furring, lathing, or accessories.

H. Coordinate installation of ceiling suspension system with installation of overhead structural system to ensure that inserts, other structural anchorage provisions have been installed to

receive ceiling hangers in a manner that will develop their full strength, at spacing required to support ceiling.
1. Furnish concrete inserts, other devices required, to other trades for installations well in advance of time needed for coordination with other work.

I. Attach hangers to structure above ceiling to comply with ML/SFA "Specifications for Metal Lathing and Furring," with referenced standards, as per requirements of applicable building codes.
1. Do not attach hangers to metal deck tabs.

J. Install ceiling suspension system components of sizes, spacing indicated, but not in smaller sizes or greater spacing than that required by referenced lathing, furring installation standards.
1. Wire Hangers: Space 8-gauge 0.16 inch (4.06 mm) diameter) wire hangers not over 4 feet (121.92 cm) o.c. parallel with, and not over 3 feet (91.44 cm) perpendicular to, direction of carrying channels, unless otherwise indicated, within 6 inches (152.4 mm) of carrying channel ends.
2. Stiff Legs at Exterior Suspension System: Space uplift restraints vertical carrying steel stud channels not over 4 feet (121.92 cm) o.c. along horizontal carrying channels. Firmly anchor vertical members to overhead structure.

K. Install components of steel stud/wall partition support systems to comply with directions of steel stud manufacturer for applications indicated and with the following:
1. For non-load (axial) bearing stud system, comply with ASTM C754.
2. For load-bearing (axial and transverse) stud systems, comply with ASTM C1007, and as indicated.

L. Steel Stud Systems to receive Metal Lath: Comply with requirements of ML/SFA "Specifications for Metal Lathing and Furring" applicable to each installation condition, type of metal stud system indicated.

M. Extend and attach partition support system to structure above suspended ceilings, unless otherwise indicated.

N. Metal Furring to Receive Metal Lath: Comply with requirements of ML/SFA "Specifications for Metal Lathing and Furring" applicable to each installation condition indicated.

O. Comply with referenced lathing and furring installation standards for provisions, location of plaster accessories of type indicated. Miter or cope accessories at corners; install with tight joints, in alignment. Attach accessories securely to plaster bases to hold accessories in place and alignment during plastering.

3.6 INSTALLING ACCESSORIES

A. Install according to ASTM C1063 and at locations indicated on drawings.

B. Reinforcement for External Corners:
1. Install lath-type, external-corner reinforcement at exterior locations.
2. Install cornerbead at exterior locations.

C. Control and Expansion Joints: Install control and expansion joints at locations indicated on Drawings.
1. At distances between control joints of not greater than 18 feet (548.64 cm) o.c. or as indicated on the drawings and required by applicable standards.
2. As required to delineate plasterwork into areas (panels) with length-to-width ratios of not greater than 2-1/2:1.
3. Where control joints occur in surface of construction directly behind plaster.
4. Where plasterwork areas change dimensions, to delineate rectangular-shaped areas (panels) and to relieve the stress that occurs at the corner formed by the dimension change.
5. Fully caulk “V” type control joints.

6. Expansion Joints: Install expansion beads at locations shown on the drawings.

D. Accessories:
1. Corner Beads: Install corner beads at horizontal and vertical corners.
2. Casing Beads: Install casing beads at locations where plaster meets other materials, and at terminations of stucco finishes. Butt and align ends.
3. Corner Opening Reinforcing: Install glass fiber mesh at 45 degrees at openings in the plane of the plaster surface such as doors and windows. Mesh strips shall be 4 inches (101.6 mm) wide and a minimum of 9 inches (228.6 mm) long, installed following manufacturer's recommendations.
4. At joints between concrete and wood, provide revel molding.
5. Install accessories to required lines and levels.

3.7 PLASTER APPLICATION

A. General: Comply with ASTM C926.
1. Do not deviate more than plus or minus 1/4 inch (6.35 mm) in 10 feet (304.8 cm) from a true plane in finished plaster surfaces, as measured by a 10-foot straightedge placed on surface.
2. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
3. Provide plaster surfaces that are ready to receive field-applied finishes indicated.

B. Bonding Compound: Apply on masonry and concrete for plaster bases.

C. Plaster Finish Coats: Apply to provide finish to match Architect's sample.

3.8 INSTALLATION OF FENESTRATION OPENING FLASHING

A. Apply at jambs, head and sill of openings unless directed otherwise.
1. Do not apply at the bottom of openings where the bottom of the opening is the interior slab.

B. Apply full depth of opening and 2-inches onto the interior and exterior wall surface per manufacturer’s installation directions.
1. Apply to fill voids and depressions to produce a uniform flat plane.

C. Install wood buck if required with a continuous bead of sealant between the buck and the flashing with one bead at the front and one at the back.

3.9 PLASTER REPAIRS

A. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

3.10 TOLERANCES

A. Maximum Variation from True Position: 1/8-inches per 10 feet.

B. Maximum Variation of any Member from Plane: 1/8-inches.

3.11 CLEANING

A. Remove temporary protection and enclosure of other work. Promptly remove plaster from door frames, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

END OF SECTION

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SECTION 09 30 00 - TILING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, materials, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Ceramic wall tile (CT-1A, CT-1B, CT1-C, CT-1D, CT-2, CT-3)
   2. Porcelain floor tile (PCT-1)

1.3 REFERENCE STANDARDS

A. ANSI/CTI A108/A118/A136.1 – Specification for the Installation of Ceramic Tile - A Collection of 20 ANSI/CTI A108 Series Standards on Ceramic Tile Installation: A108.1A-C, 108.4 -.13, A118.1-.10, ANSI A136.1.

B. ANSI/CTI A108.10 – Installation of Grout in Tile work.

C. ANSI/CTI A118.6 – Ceramic Tile Grouts.

D. ANSI/CTI A137.1 – Ceramic Tile.

E. TCA CTI – (Tile Council of North America) - Handbook for Ceramic Tile Installation.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements, for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 – Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 – Product Requirements for substitution procedures.

C. Product Data: For each type of product.

D. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

E. Samples: For tile, grout, and accessories involving color selection.
   1. Full-size units of each type and composition of tile and for each color and finish required.
   2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12 inches (304.8 mm) by 36 inches (914.4 mm) square, but not fewer than four tiles. Use grout of type and in color or colors approved for completed Work.
   3. Full-size units of each type of trim and accessory for each color and finish required.
   4. Stone thresholds in 6-inch lengths.
   5. Metal edge strips in 6-inch lengths.

F. Manufacturer's Certificate: Certify that products meet or exceed ANSI A137.1.

1.6 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Provide products from a firm that makes the indicated products as a regular production item and with not less than five (5) years experience.

B. Manufacturer's Qualifications: Experienced firm in the manufacture of products and/or systems similar to those required for this Project and with a record of successful in-service performance as well as sufficient production capacity to produce units as required.

C. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation of specified materials and assemblies with not less than five (5) years experience.

D. Installer's Qualifications: Work done under this Section of the Specifications shall be performed by mechanics skilled and experienced in the class of Work involved having successfully installed not less than 5 projects of similar size and scope to work of this Project. Installer shall be familiar with special requirements as herein indicated and shall comply with requirements of authorities having jurisdiction.

E. Workmanship shall be in accordance with best trade practices, and surface shall be true to line and free from waves and other imperfections. Joints between tiles shall be maintained uniform and even and properly grouted.

F. Work shall comply with applicable requirements of the following:
   1. Tile Council of North America (TCNA) Installation Guidelines.
   2. ANSI A108 Series.

1.7 ATTIC STOCK

A. Furnish extra materials described below that match products installed, packaged with protective covering for storage, and identified with labels describing contents.
   1. Furnish quantity of full-size units equal to 2.0% of amount installed.

1.8 MOCK-UPS

A. Mockups: Before installing tile, construct mockups for each form of construction and finish required to verify selections made under Sample submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for completed Work.
   1. Locate mockups in the location and of the size indicated, or, if not indicated, as directed by Architect.
   2. Demonstrate the proposed range of aesthetic effects and workmanship.
   3. Obtain Architect's approval of mockups before proceeding with final unit of Work.
   4. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
      a. Approved mockups in an undisturbed condition at the time of Substantial Completion may become part of the completed Work.

1.9 PRE-INSTALLATION MEETING

A. The Contractor shall conduct a pre-installation meeting at the project site a minimum of 30 days prior to any work being installed as indicated in this section and other related sections that require coordination with this section.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

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1.11 FIELD CONDITIONS

A. This Contractor shall inspect the job condition before starting, and his starting work constitutes approval of conditions.

B. All flooring variations less than 1/8” in 10 feet (304.8 cm), chips, and cracks are the responsibility of the flooring subcontractor to feather/patch prior to the installation of tile.

C. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.12 WARRANTY

A. This Contractor shall fully guarantee all materials and labor under this section for a period of not less than 1-year from date of final acceptance of the building against all defects in both workmanship and materials, and he shall promptly correct and/or replace such faulty work if so notified.

1.13 PERFORMANCE REQUIREMENTS

A. Tile installation shall comply with the “Handbook for Ceramic Tile Installation” by the Council of North America (TCNA).

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
   1. Porcelain Tile: American Olean; www.americanolean.com
   2. Ceramic Tile: Daltile; www.daltile.com

B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
   1. Crossville.
   2. Florida Tile.

2.2 GENERAL

A. Provide tile conforming to ANSI A137.1.

B. Tile shall meet or exceed the ADAAG slip resistance coefficient of 0.42 or greater.

2.3 CERAMIC WALL TILE (CT-1A, CT-1B, CT-1C, CT-1D, CT-2, CT-3)

A. Basis of Design Products: Refer to "Finish Color Summary Chart" on Drawings for product selections.

B. Size: As indicated on Drawings.

C. Color: As indicated on Drawings.

D. Installation Pattern: As indicated on Drawings.

2.4 PORCELAIN FLOOR TILE (PCT-1)

A. Basis of Design Product: Refer to "Finish Color Summary Chart" on Drawings for product selections.

B. Size: As indicated on Drawings.

C. Color: As indicated on Drawings.

D. Installation Pattern: As indicated on Drawings.

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2.5 PROJECT COLORS AND PATTERNS

A. Colors, surface textures, and other appearance characteristics shall be as selected by the Architect. Selections shall be made from among manufacturer's standard products, regardless of differing price groupings.

B. Architect reserves the right to use a maximum of two (2) colors in each room/space at no additional cost.

C. Architect shall select colors of tile from full range of available colors / price groups for all selections unless indicated otherwise.

D. Architect shall select colors of grout from all available price groups.

2.6 MATERIALS

A. Anti-Fracture Membrane/Cleavage Membrane: As indicated on the drawings, and elsewhere as required for isolating the installation from cracking due to minor substrate movement and normal structural deflections. Membrane shall comply with ANSI A108.1, one layer of 15# felt with 3" overlaps at all seams.
   1. Apply at crack locations.
   2. Membrane: Liquid applied elastomeric membrane complying with ASTM C627 and ASTM E96 Method E “Mapelastic AquaDefense” as manufactured by Mapei Corporation.

B. Waterproof Membranes:
   1. Install beneath tile at restrooms with drains and second floor restrooms.
   2. General: Provide products that comply with ANSI A118.10.
   3. Membrane: Liquid applied elastomeric membrane complying with ASTM C627 and ASTM E96 Method E “Mapelastic AquaDefense” as manufactured by Mapei Corporation.

C. Self-Leveling Underlayment: Quick set type, as recommended by membrane manufacturer, required to provide a flat, level surface for direct receipt of tile and other floor coverings on dry, interior installations.

D. Latex Underlayment: Quick set type, as recommended by membrane manufacturer, as required providing positive drainage to floor drains.

E. Mortar:
   1. Modified Dry-Set Mortar (Thinset): ANSI A118.4.
      a. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
      b. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.
   2. Medium-Bed Modified Dry Set Mortar: Comply with ANSI A118.4, large tile
   3. Mortar Bed Installations: As indicated on the drawings, and elsewhere as required for mortar bed or brown coat as the substrate for tile work; work to conform to ANSI A108.1.

F. Organic Tile Adhesives: ANSI A136.1 thinset bond type, use Type 1 inch (25.4 mm) areas not exposed to prolonged moisture.

G. Epoxy Adhesives: Chemical Resistant Epoxy, Water-Cleanable Tile Setting Epoxy as required for setting tike as specified by ANSI A118.3 and ANSI A108.6. Product shall be “Latapoxy 300” as manufactured by Laticrete or approved equal. Provide in restrooms and where indicated.

H. Grout:
   1. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
      a. Laticrete: www.laticrete.com

2. Basis of Design Product: Refer to "Finish Color Summary Chart" on Drawings for product selection.
    a. Material: High-performance, polymer-fortified, cement-based grout.
    b. Joint Width: 1/8 inch (3.18 mm)
    c. Grout color: As indicated on Drawings.

I. Elastomeric Joint Caulk: ANSI A108.01.3.7, provide in all joints between floors and walls and at joints between tile and dissimilar materials and as indicated on the Drawings.

2.7 ACCESSORIES

A. The Contractor to supply all necessary base, cap edge corner, trim, or accessory tiles required for a complete installation.

B. Edge Trim:
1. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
    a. Schluter: www.schluter.com
2. Basis of Design Product: “Schiene”
3. Material: Extruded aluminum, satin nickel anodized aluminum finish, mechanically fastened, gluing is not permitted.
4. Provide at all edges unless indicated otherwise.

C. Grout Sealer: Manufacturer’s standard product for cleaning, brightening, and sealing grout joints that does not change color appearance of grout.

2.8 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturer’s written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

2.9 ENVIRONMENTAL

A. Adhesives: For adhesives and sealants, including printed statement of VOC content.

B. Urethane Crack Isolation Membrane and Tile-Setting Adhesive: One-part, liquid-applied urethane, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), in a consistency suitable for trowel application and intended for use as both waterproofing and tile-setting adhesive in a two-step process.

C. Water-Cleanable, Tile-Setting Epoxy: ANSI A118.3, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Organic Adhesive: ANSI A136.1, Type I, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 EXECUTION

3.1 INSPECTION

A. Prior to installing tile, inspect new surfaces that are to receive tile covering. Notify the Architect in writing of defects or conditions that will interfere with or prevent a satisfactory tile installation. Do not proceed with installation until such defects or conditions have been corrected.

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1. Verify that substrates for setting tile are firm; dry; clean; free from oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 series of tile installation standards for installations indicated.
2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust latter in consultation with Architect.

B. The starting of installation work in a room or space shall imply acceptance of the surfaces to receive the tile in that space.

3.2 PREPARATION

A. Repair minor holes, cracks, depressions, and rough areas, using leveling and patching compounds as recommended by tile manufacturer.

B. Clear away debris, scrape up cementitious deposits from surface that would prevent bond, including curing compounds, paint, oils, waxes, and sealers. Broom clean or vacuum surfaces to be covered immediately before installation.

C. Field Applied Temporary Protective Coating: Where indicated under tile type or needed to prevent adhesion or staining of exposed tile surfaces by grout, protect exposed surfaces of tile against adherence of mortar and grout by precoating them with a continuous film of temporary protective coating indicated below, taking care not to coat unexposed tile surfaces:
   1. Petroleum paraffin wax or grout release.

3.3 TILE INSTALLATION

A. Install tile, per TCA F113-90 sloping to floor drains, where applicable, in accordance with ANSI specification A-108.5.

B. General: Install tile to comply with requirements in the Ceramic Tile Floor Installation Schedule, including those referencing TCA installation methods and ANSI A108 series of tile installation standards.

C. Install types of tile designated for wall installations to comply with requirements in the Ceramic Tile Wall Installation Schedule, including those referencing TCA installation methods and ANSI setting-bed standards.

D. Install wall tile trim per manufacturer's directions and locate joints at lower portion of wall.

E. Install metal edge trim where tile abuts other floor finishes.

F. Provide a 1/8" joint between the tile, and the doorframe or other item of dissimilar material then use a sealant over the joint instead of grout.
   1. Caulk the joints with caulking compound that matches grout.

G. Use masonry saw to cut tile unless Architect and Owner approve another method.

H. Extend tile work into recesses and under or behind equipment and fixtures to form a complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

I. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are the same size. Lay out tile work and center tile fields in both directions.

J. Cove base shall be installed flush with the adjacent floor tile and not on top of the floor tile.

3.4 LAYOUT

A. Locate expansion joints and other sealant filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw cut joints after installation of tiles.
   1. Locate joints in tile surfaces directly above joints in concrete surfaces.

2. Prepare joints and apply sealants to comply with requirements of Specification Section - Joint Sealants.
3. Control joints locations and details shall comply with TCNA EJ171 recommendations.

B. Lay out tilework so as to minimize cuts less than one-half tile in size.

C. Locate cuts in both walls and floors so as to be least conspicuous.

D. Lay out tile wainscots to next full tile beyond dimensions shown.

E. Align wall joints to give straight, uniform grout lines, plumb and level.

F. Align floor joints to give straight uniform grout lines parallel with walls.

G. Make joints between tile sheets same width as joints within sheets so extent of each sheet is not apparent in finished work.

H. Porcelain tile can have large variances in sizing. Do not mix sizes and types of tiles in pattern areas. Joints that do not line up or joint widths that vary will be unacceptable.

3.5 WORKMANSHIP

A. Supply first-class workmanship in tilework.

B. Use products in strict accordance with recommendations and directions of manufacturer.

C. Proportion mixes in accordance with latest ANSI standard specifications.

D. Smooth exposed cut edges.

E. Be sure cut edges are clean before installing tiles.

F. Fit tile carefully against trim and accessories, also around pipes, electrical boxes, and other built-in fixtures so that escutcheons, plates, and collars will completely overlap cut edges.

G. When using glazed tile sheets, minimize tearing sheets apart by drilling pipe holes as much as possible.

H. Be sure tile work is free of grout film upon completion.

3.6 WATERPROOFING INSTALLATION

A. Install waterproofing to comply with waterproofing manufacturer’s written instructions to produce a waterproof membrane of uniform thickness bonded securely to substrate.

B. Do not install tile over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.7 ANTI-FRACTURE MEMBRANE/CLEAVAGE MEMBRANE

A. Install anti-fracture membrane/cleavage membrane to comply with manufacturer’s written instructions over cracks in the substrate.

3.8 GROUTING

A. Grouting shall be installed in accordance with ANSI A108.10 and the manufacturer's recommended procedures and precautions during application and cleaning, unless noted otherwise.

B. Rinse tilework thoroughly with clean water before and after using chemical cleaners.

3.9 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all tile surfaces so they are free of foreign matter.
1. Remove latex-Portland cement grout residue from tile as soon as possible.
2. Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer’s written instructions, but no sooner than 10 days after installation. Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning. Flush surface with clean water before and after cleaning.

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3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to brick and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

B. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work.

C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, to ensure tile is without damage or deterioration at the time of Substantial Completion.
   1. When recommended by tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
   2. Prohibit foot and wheel traffic from tiled floors for at least 7 days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

3.10 PROTECTION

A. The Contractor installing tile shall make such provisions as necessary to protect the tile against damage of any kind after installation. Damaged tile that appears in the finish work prior to turning the building over to the Owner is to be repaired or replaced by this Contractor without further cost to the Owner. Protect adjoining areas and surfaces and clean up everything at completion. Remove scrap, debris, and surplus material as it accumulates.

END OF SECTION

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SECTION 09 51 00 - ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units (ACT1).

1.3 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

C. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2023, with Editorial Revision (2024).

D. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.

E. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019 (Reapproved 2025).

F. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2026.

G. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2024a.

H. ASTM E795 - Standard Practices for Mounting Test Specimens during Sound Absorption Tests; 2023.

I. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2023.

J. ITS (DIR) - Directory of Listed Products; Current Edition.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Do not install acoustical units until after interior wet work is dry.

1.6 SUBMITTALS

A. Refer to Section 01 30 00.0 - Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 – Product Requirements for substitution procedures.

C. Shop Drawings: Indicate grid layout and related dimensioning, junctions with other ceiling finishes, and mechanical and electrical items installed in the ceiling.

D. Product Data: Provide data on suspension system components and acoustical units.

E. Samples:

1. Acoustical units: Submit two samples illustrating material and finish of acoustical units.
2. Suspension system: Submit two samples each, 12 inches long, of suspension system main runner, cross runner, and perimeter molding.

F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

G. Manufacturer's qualification statement.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

1.7 QUALITY ASSURANCE

A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.8 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Rating: Determined in accordance with test procedures in ASTM E119 and complying with the following:
1. Local authorities having jurisdiction.

B. Seismic Performance: Ceiling systems designed to withstand the effects of earthquake motions determined according to ASCE 7 for Seismic Design Category D, E, or F and complying with the following:
1. Local authorities having jurisdiction.

1.9 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F (16 degrees C), and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.

B. Acoustic Tiles/Panels:
1. Armstrong World Industries, Inc: www.armstrongceilings.com/#sle.
2. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
a. Certainteed Architectural: www.certainteed.com/ceilings-and-walls/#sle.
b. Gold Bond - National Gypsum.
c. Rockfon: www.rockfon.com/#sle.
d. USG Corporation: www.usg.com/ceilings/#sle.

C. Suspension Systems:
1. Same as for acoustical units.
2. Armstrong World Industries, Inc: www.armstrongceilings.com/#sle.
3. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
a. Certainteed Architectural: www.certainteed.com/ceilings-and-walls/#sle.
b. Gold Bond - National Gypsum.
c. Rockfon: www.rockfon.com/#sle.

d. USG Corporation: www.usg.com/ceilings/#sle.

2.2 ACOUSTICAL UNITS

A. Acoustical Units - General: ASTM E1264, Class A.

B. Acoustical Panels, Type ACT1:
   1. Basis of Design Product: "Fine Fissured"
   2. Edge: Angled Tegular.
   3. Size: 24"
   4. NRC: 0.70
   5. Color: White.

C. ----------

D. ASTM E1264 Type A, Form A3 - Mineral fiber with scrubbable finish, typical in commercial kitchen/food prep areas.

E. ----------

F. ----------

G. ASTM E1264 Type A, Form A4 - Mineral base with plastic or aluminum faced overlay; cleanroom classified option.

H. ----------

I. ----------

J. ASTM E1264 Types C and D - Metal-faced acoustical panels (Type C) and planks (Type D).

K. ----------

L. ----------

M. ASTM E1264 Type F - Wood with a mineral or glass fiber backing, Forms F1 (perforated) and F2 (non-perforated).

N. ----------

O. ----------

P. ASTM E1264 Type G - Gypsum, Forms G1 (perforated) and G2 (non-perforated).

Q. ----------

R. ----------

S. ASTM E1264 Type J - Melamine foam tiles, planks, and panels.

T. ----------

2.3 SUSPENSION SYSTEMS

A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold-down clips, stabilizer bars, clips, and splices as required.
   1. Materials:
      a. Steel Grid: ASTM A653/A653M, G30 coating, unless otherwise indicated.

B. Exposed Suspension System:
   1. Basis of Design: “Prelude XL 15/16" Steel Exposed Tee”.
   2. Structural Classification: Intermediate Duty System.
   3. Color: White.
   4. Metal Suspension-System Standard: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.
   5. Electrogalvanized in all spaces unless indicated otherwise.

6. Hot-dipped galvanized shall be used in the food service related areas.
7. High-Humidity Finish: Provide coating tested and classified for "severe environment performance" according to ASTM C 635/C 635M in food service, damp, and potentially wet spaces.
    a. Provide aluminum cap in food preparations areas and associated spaces.
    b. Provide aluminum cap in spaces that may experience damp or wet conditions.
8. End Condition of Cross Runners: Override (stepped) or butt-edge type, as standard with manufacturer.

2.4 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
    1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E 488/E 488M or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
        a. Type: Postinstalled expansion anchors.
        b. Corrosion Protection: Carbon-steel components zinc plated according to ASTM B 633, Class SC 1 (mild) service condition.
    2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E 1190, conducted by a qualified testing and inspecting agency.

B. Wire Hangers, Braces, and Ties:
    1. Provide wires as follows:
        a. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
        b. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106 inch diameter wire.

C. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

D. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.

E. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 coating designation; with bolted connections and 5/16-inch diameter bolts.

F. Metal Edge Moldings and Trim:
    1. Roll-Formed, Sheet-Metal Edge Moldings, and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations complying with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for of suspension-system runners.
    2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
    3. Provide manufacturer's standard edge moldings that fit acoustical tile edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.
    4. Ceiling Edge Trim: Provide “Straight Axiom Classic Trim” as manufactured by Armstrong World Industries.
        a. Provide wherever a lay-in ceiling is located lower than an adjacent gypsum board ceiling.

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b. Provide outside and inside corner trim, splice plates, clips, and miscellaneous items for a complete installation.
c. Size: 6” or as indicated on the drawings.
d. Color: As selected by the Architect.

G. Gypsum Board: Fire rated type; 5/8 inch (16 mm) thick, ends and edges square, paper faced.

H. Acoustical Sealant: Manufacturer's standard sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90. Exposed and concealed joints nonsag, paintable, nonstaining latex sealant.

2.5 ENVIRONMENTAL

A. Recycled Content: Provide acoustical panels with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 20 percent by weight.

B. Adhesives: For adhesives, sealants, and chemical-bonding compounds, including printed statement of VOC content.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.2 PREPARATION

A. Install after major above-ceiling work is complete.

B. Coordinate the location of hangers with other work.

3.3 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions, as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Locate system on room axis according to reflected plan.

D. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

E. Seismic Suspension System, Seismic Design Category C: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Maintain a 3/8 inch (9 mm) clearance between grid ends and wall.

F. Seismic Suspension System, Seismic Design Categories D, E, F: Hang suspension system with grid ends attached to the perimeter molding on two adjacent walls; on opposite walls, maintain a 3/4 inch (19 mm) clearance between grid ends and wall.

G. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

H. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

I. Support fixture loads using supplementary hangers located within 6 inches (152 mm) of each corner, or support components independently.

J. Do not eccentrically load system or induce rotation of runners.

K. Install light fixture boxes constructed of gypsum board above light fixtures in accordance with fire rated assembly requirements and light fixture ventilation requirements.

3.4 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

E. Cutting Acoustical Units:
   1. Make field cut edges of same profile as factory edges.

3.5 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.6 CLEANING

A. Clean surfaces.

B. Replace damaged or abraded components.

END OF SECTION

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SECTION 09 65 00 - RESILIENT FLOORING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications and the Sections included under Division 1, General Requirements and References are included References are included.

1.2 SECTION INCLUDES

A. Resilient sheet flooring (SV-1).

B. Resilient tile flooring (LVT-1).

C. Resilient base (RB-1).

D. Resilient stair accessories.

E. Installation accessories.

1.3 REFERENCE STANDARDS

A. ASTM D6329 - Standard Guide for Developing Methodology for Evaluating the Ability of Indoor Materials to Support Microbial Growth Using Static Environmental Chambers; 1998 (Reapproved 2023).

B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2023.

C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.

D. ASTM F970 - Standard Test Method for Measuring Recovery Properties of Floor Coverings after Static Loading; 2022.

E. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile; 2025.

F. ASTM F1700 - Standard Specification for Solid Vinyl Floor in Modular Format such as Tile(s) or Plank(s); 2025.

G. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021 (Reapproved 2025).

H. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.

I. ASTM F1913 - Standard Specification for Vinyl Sheet Floor Covering Without Backing; 2019 (Reapproved 2025).

J. ASTM F2169 - Standard Specification for Resilient Stair Treads; 2015 (Reapproved 2025).

K. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

L. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2023.

M. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; 2018.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 – Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 – Product Requirements for substitution procedures.

C. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

D. Shop Drawings: Indicate seaming plans and floor patterns.

E. Verification Samples: Submit two samples, 12 by 24 inch (___ by ___ mm) in size illustrating color and pattern for each resilient flooring product specified.

F. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.

G. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of subfloor is acceptable.

H. Manufacturer's Qualification Statement.

I. Installer's Qualification Statement.

J. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

K. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Flooring Material: 100 square feet (9.3 square meters) of each type and color.
   2. Extra Wall Base: 100 linear feet (9.3 linear meters) of each type and color.
   3. Extra Stair Materials: Quantity equivalent to 5 percent of each type and color.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum three years documented experience.

B. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.

C. Testing Agency Qualifications: Independent firm specializing in performing concrete slab moisture testing and inspections of the type specified in this section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.

B. Store all materials off of the floor in an acclimatized, weather-tight space.

C. Maintain temperature in storage area between 55 degrees F (13 degrees C) and 90 degrees F (72 degrees C).

D. Protect roll materials from damage by storing on end.

E. Do not double stack pallets.

1.8 FIELD CONDITIONS

A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F (21 degrees C) to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F (13 degrees C).

PART 2 PRODUCTS

2.1 SHEET FLOORING

A. Vinyl Sheet Flooring - Type SV-1: Homogeneous without backing, with color and pattern throughout full thickness.
   1. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
      a. Tarkett Flooring; Homogeneous Sheet Vinyl: www.tarkett.com

b. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
   1) Armstrong Flooring: www.armstrongflooring.com
   2) Mannington Commercial: www.manningtoncommercial.com

2. Basis of Design Product: Refer to "Finish Color Summary Chart" on Drawings for product selection.
3. Minimum Requirements: Comply with ASTM F1913.
4. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
5. VOC Content Limits: As specified in Section 01 61 16.
6. Thickness: 0.080 inch (2.0 mm) nominal.
7. Sheet Width: 49 inch (1250 mm) minimum.
8. Static Load Resistance: 250 psi (1725 kPa) minimum, when tested as specified in ASTM F970.
9. Seams: Heat welded.
10. Integral coved base with cap strip.
11. Pattern: As indicated on drawings.
12. Color: As indicated on drawings.

B. Feature Strips: Of same material as sheet flooring, ____ inch (____ mm) wide.

C. Welding Rod: Solid bead in material compatible with flooring, produced by flooring manufacturer for heat welding seams, and in color matching field color.

2.2 TILE FLOORING

A. Luxury Vinyl Tile - Type LVT-1: Homogeneous, with color extending throughout thickness.
1. Manufacturers:
   a. Armstrong Flooring: www.armstrongflooring.com
   b. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
      1) Tarkett Flooring: www.tarkett.com
2. Basis of Design Product: Refer to "Finish Color Summary Chart" on Drawings for product selection.
3. Minimum Requirements: Comply with ASTM F1066, of Class corresponding to type specified.
4. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
5. Size: 12 by 12 inch (305 by 305 mm).
6. VOC Content Limits: As specified in Section 01 61 16.
7. Thickness: 0.125 inch (3.2 mm).
8. Pattern: As indicated on drawings.
9. Color: As indicated on drawings.

B. Feature Strips: Of same material as tile, ____ inch (____ mm) wide.

2.3 STAIR COVERING

A. Stair Treads with Integral Risers: Rubber; full height of riser, full width and depth of tread in one piece; tapered thickness.
1. Minimum Requirements: Comply with ASTM F2169, Type TS, rubber, vulcanized thermoset.
2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
3. Nominal Thickness: 0.1875 inch (4.75 mm).

2.4 RESILIENT BASE

A. Resilient Base - Type RB-1: ASTM F1861, Type TS, rubber, vulcanized thermoset; Style B, Cove.

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1. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
   a. Tarkett / Johnsonite: www.tarkett.com
   b. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
      1) Mannington Commercial: www.manningtoncommercial.com
      2) Roppe Corporation: www.roppe.com
2. Basis of Design Product: Refer to "Finish Color Summary Chart" on Drawings for product selection.
3. Material: Thermoset rubber.
4. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
5. Height: 4 inches (100 mm), and as indicated on drawings.
6. Thickness: 0.125 inch (3.2 mm).
7. Finish: Satin.
8. Length: Roll.
9. Color: As indicated on drawings.
10. Accessories: Premolded external corners and internal corners.

2.5 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.

B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.

C. Moldings, Transition and Edge Strips: Same material as flooring.

D. Filler for Coved Base: Plastic.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are smooth and flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, dust-free, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
   1. Test in accordance with Section 09 05 61.
   2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

3.2 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.

C. Prohibit traffic until filler is fully cured.

D. Clean substrate.

3.3 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of subfloor conditions.

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B. Install in accordance with manufacturer's written instructions.

C. Adhesive-Applied Installation:
   1. Spread only enough adhesive to permit installation of materials before initial set.
   2. Fit joints and butt seams tightly.
   3. Set flooring in place, press with heavy roller to attain full adhesion.

D. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.

E. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.4 INSTALLATION - SHEET FLOORING

A. Lay flooring with joints and seams parallel to longer room dimensions, to produce minimum number of seams. Lay out seams to avoid widths less than 1/3 of roll width; match patterns at seams.

B. Seal seams by heat welding where indicated.

C. Coved Base: Install as detailed on drawings, using coved base filler as backing at floor to wall junction. Extend sheet flooring vertically to height indicated, and cover top edge with metal cap strip.

3.5 INSTALLATION - TILE FLOORING

A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.

B. Install square tile to ashlar pattern. Allow minimum 1/2 full size tile width at room or area perimeter.

3.6 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches (45 mm) between joints.

B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

D. Scribe and fit to door frames and other interruptions.

3.7 INSTALLATION - STAIR COVERINGS

A. Install stair coverings in one piece for full width and depth of tread.

B. Adhere over entire surface. Fit accurately and securely.

3.8 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

3.9 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

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SECTION 09 65 66 - RESILIENT ATHLETIC FLOORING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

1.3 REFERENCE STANDARDS

A. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015 (Reapproved 2021).

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.

C. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.

D. ASTM F2772 - Standard Specification for Athletic Performance Properties of Indoor Sports Floor Systems; 2024.

1.4 SUBMITTALS

A. Refer to Section 01 30 00.0 - Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 – Product Requirements for substitution procedures.

C. Product Data: Manufacturer's printed data sheets for products specified.

D. Shop Drawings: Fabrication and installation details, and layout, colors, and widths of game lines and equipment locations.

E. Verification Samples: Actual flooring material specified, not less than 12 inch (305 mm) square, mounted on solid backing.
   1. Include samples of game lines, illustrating colors selected.

F. Test Reports: Submit test reports showing compliance with ASTM F2772.

G. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.

H. Manufacturer's Instructions: Indicate standard and special installation procedures.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in unopened containers clearly labeled with manufacturer's name and identification of contents.

B. Store materials in dry and clean location until needed for installation. During installation, handle in a manner that will prevent marring and soiling of finished surfaces.

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1.7 FIELD CONDITIONS

A. Maintain temperature in spaces to receive adhesively installed resilient flooring within range of 70 to 95 degrees F (21 to 35 degrees C) for not less than 48 hours before the beginning of installation and for not less than 48 hours after installation has been completed. Subsequently, do not allow temperature in installed spaces to drop below 50 degrees F (10 degrees C) or to go above 100 degrees F (38 degrees C).

PART 2 PRODUCTS

2.1 PREFORMED ATHLETIC FLOORING

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
   1. Mondo America, Inc: www.mondoworldwide.com
   2. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
      a. Aacer Sports Flooring: www.aacerflooring.com
      b. Burke Flooring: www.burkeflooring.com

B. Rubber Sheet Flooring (RSF-1):
   1. Basis of Design Product: Refer to "Finish Color Summary Chart" on Drawings for product selection.
   2. Material: Two-layer vulcanized rubber.
   3. Thickness: As indicated on drawings.
   4. Underlayment: Manufacturer's standard shock absorbing, synthetic rubber underlayment.
   5. Sheet Width: Minimum 48 inches (1220 mm).
   6. Durometer Hardness, Type A: Minimum of 75, when tested in accordance with ASTM D2240.
   7. Durometer Hardness, Wear Layer, Type A: Minimum of 80, when tested in accordance with ASTM D2240.
   8. Durometer Hardness, Bottom Layer, Type A: Minimum of 70, when tested in accordance with ASTM D2240.
   9. Surface Pattern: As indicated on drawings.
   10. Color: As indicated on drawings.

2.2 ACCESSORIES

A. Flooring Adhesive: Provide adhesive certified by rubber athletic flooring manufacturer:
   1. PU 105 polyurethane adhesive.
   2. Refer to current guidelines on product mixing and use, as published by the Manufacturer.
   3. EP 55 epoxy adhesive may be used in areas that have not been specified for use with manufacturer's recommended underlayment, and that will not be subject to impacts or dynamic loads such as bleachers.

B. Sealer: Manufacturer recommended epoxy sealer or equal.

C. Trim:
   1. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
   2. Schulter Systems, Inc.
      a. Basis of Design Product: “Quadel” No. Q150EB

3. Finish: Brushed stainless steel.
4. Install at top and sides of flooring material that is extended up walls as indicated on Drawings.
5. Trim adhesive Basis of Design Product: Trim manufacturer's standard "Kerdi-Fix"

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates for conditions detrimental to installation of athletic flooring. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of athletic flooring to substrate.

3.2 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Remove coatings that are incompatible with flooring adhesives, using methods recommended by flooring manufacturer.

C. Seal floors with epoxy sealer as recommended by manufacturer.

D. Move flooring and installation materials into spaces where they will be installed at least 48 hours in advance of installation unless manufacturer recommends a longer period in writing.
   1. Do not install flooring until they are same temperature as space where they are to be installed.

E. Broom clean areas to receive athletic flooring immediately before beginning installation.
   1. Sweep and vacuum clean substrates to be covered by flooring immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install in accordance with manufacturer's written instructions.

3.4 GAME LINES AND LOGOS

A. Lay out game lines and logos to comply with rules and diagrams published by National Federation of State High School Association for the sports activities indicated.

B. Mask flooring at game lines and logos, and apply paint recommended by the rubber flooring manufacturer of color indicated to produce clean, sharp, and distinct edges.

3.5 CLEANING

A. Clean flooring using methods recommended by manufacturer.

3.6 PROTECTION

A. Protect finished athletic flooring from construction traffic to ensure that it is without damage upon Date of Substantial Completion.

END OF SECTION

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SECTION 09 68 00 - TILE CARPETING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Carpet Tile (CPT-1, CPT-2, CPT-3, CPT-4, CPT-5).
   2. Walk-Off Mat (WM).
   3. Carpet Accessories.

1.3 REFERENCE STANDARDS

A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2016 (Reapproved 2021).

B. ASTM D5116 - Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products; 2017.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

D. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2023.

E. ASTM E662 - Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials; 2021a, with Editorial Revision.

F. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.

G. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.

H. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

I. CRI 104 - Standard for Installation of Commercial Carpet; 2015.

J. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2023.

K. AATCC – American Association of Textile Colorist and Chemists.

L. Florida Department of Agriculture and Consumer Services, Consumer Products Laboratory: Certified Carpet Products.

M. FCIB – Flooring Covering Installation Board.

N. CRI – Carpet and Rug Institute.

O. FSPMA – Florida School Plant Management Association, Inc.

P. Floor Covering Installation Contractor’s Association.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements, for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

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1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 - Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 - Product Requirements for substitution procedures.

C. Product Data: For each type of product indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance. Include installation methods.

D. Shop Drawings: Show the following:
   1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
   2. Carpet type, color, and dye lot.
   3. Type of subfloor.
   4. Type of installation and pattern of installation.
   5. Pattern type, location, and direction.
   6. Type, color, and location of insets, borders edge, transition, and other accessory strips.
   7. Transition details to other flooring materials.

E. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
   1. Carpet: Four (4) full-size samples for each type specified.
   2. Exposed Edge Stripping and Accessory: 12-inch long Samples.

F. Maintenance Data: For carpet to include in maintenance manuals specified in and include the following:
   1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
   2. Precautions for cleaning materials and methods that could be detrimental to carpet.

G. Qualification Data: For Installer.

H. Product Test Reports: For carpet, for tests performed by a qualified testing agency.

I. Sample Warranty: For special warranty.

J. Maintenance Data: Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.

K. Precautions for cleaning materials and methods that could be detrimental to carpet and carpet cushion.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Carpet manufacturer shall have no less than 5 years experience of producing recyclable carpet and shall have published product literature clearly indicating compliance with requirements of this section.

B. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements and has successfully installed similar products to those required as work of this Project for not less than five (5) years.
   1. Additional Installer Qualifications: Carpet manufacturer shall provide written approval to Owner that installer is an approved installer for all carpet materials specified on this project.
   2. Employ only experienced Contractors (Installers) skilled in the successful installation of specified materials and assemblies on similar projects for not less than five (5) years.

C. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

D. Fire-Test-Response Ratings: Where indicated, provide carpet identical to those of assemblies tested for fire response per NFPA 253 by a qualified testing agency.

1.7 PERFORMANCE REQUIREMENTS

A. Carpet shall conform to the following performance characteristics:
   1. Smoke Density: ASTM E662 Less than 450.
   2. Flammability: ASTM E648 Class 1 (Glued Down).
   3. Static Propensity: AATCC 134 Under 3.5 KV.
   4. Comply with ASTM D2859, Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials.
      a. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm.

1.8 MOCK-UPS

A. Before installing carpet, install mockups for each type of carpet installation required to demonstrate aesthetic effects and qualities of materials and execution. Install mockups to comply with the following requirements, using materials indicated for the completed Work:

B. Install mockups in the location and of the size indicated or, if not indicated, as directed by Architect.

C. Notify Architect seven (7) days in advance of dates and times when mockups will be installed.

D. Demonstrate the proposed range of aesthetic effects and workmanship.

E. Obtain Architect's approval of mockups before starting work.

F. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

G. Remove mockups when directed.

H. Approved mockups may become part of the completed Work if undamaged at time of Substantial Completion.

1.9 PRE-INSTALLATION MEETING

A. The Contractor shall conduct a pre-installation meeting at the project site a minimum of 30 days prior to any work being installed as indicated in this section and other related sections that require coordination with this section.

B. Pre-installation conference shall be conducted at the project site.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI's "CRI Carpet Installation Standard."

B. Deliver carpet in original mill protective covering with mill register numbers and tags attached.

1.11 PROJECT CONDITIONS

A. General: Comply with CRI 104, Section 6.1, "Site Conditions; Temperature and Humidity."

B. Environmental Limitations: Do not deliver or install carpet until building is enclosed, wet work in spaces is complete and dry, HVAC system is operating, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

C. Do not install carpet over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

1.12 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

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1. Carpet: Full-size units equal to 10 percent of amount installed for each type indicated.
2. Attic stock shall be designated for use only after completion of Project and shall not be used for repair or replacement during warranty period.
3. Turn over all extra carpet not needed to complete the installation.

1.13 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Carpet Warranty: Written warranty, non-prorated, signed by carpet manufacturer agreeing to replace carpet that does not comply with requirements or that fails within specified warranty period.
1. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, more than ten percent (10%) loss of face fiber/yarn loss by weight normal use, edge raveling, runs, loss of tuft bind strength, dimensional stability, excess static discharge, delamination and stain resistance.
3. Warranty Period: Fifteen (15) years from Date of Substantial Completion.
4. Static electricity will maintain static below 3.5 kv at 70º and 20% relative humidity.
5. Handle any adjustments during the warranty period within fifteen (15) days of written notice.
6. The backing structure will not delaminate from the face structure nor will there be any shrinkage affecting the performance of the face and backing structure for fifteen (15) years.

C. Installer’s Warranty: Contractor (Installer) shall fully guarantee installation against defects in materials, workmanship, seaming, and loss of adhesion for indicated warranty period.
1. During warranty period, Installer shall repair or replace all defective areas as directed and at no cost to the Owner.
2. Warranty Period: Not less than 1 year from Date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
1. Interface Flooring Systems, Inc.

B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
1. Mannington Commercial: www.manningtoncommercial.com
2. Mohawk Group: www.mohawkgroup.com

2.2 CARPET TILE (CPT-1, CPT-2, CPT-3, CPT4, CPT-5)

A. Basis of Design Product(s): Refer to "Finish Color Summary Chart" on Drawings for product selections.

B. Construction: Tufted Textured Loop.

C. Style: Plank.

D. Size: As indicated on Drawings.

E. Backing System: As recommended by Manufacturer.

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F. Fiber Content: 100% Recycled Content Nylon.

G. Pile Thickness: 0.097 in., 2.5 mm

H. Pile Density: 0.097 in., 2.5 mm

I. Color: As indicated on Drawings.

J. Pattern: As indicated on Drawings.

K. Dye Method: Solution dyed.

2.3 WALK-OFF MAT (WM)

A. Product Description:
   1. Basis of Design Product: “Entry Level”
   2. Fiber Content: 100% nylon Type 6.6
   3. Dye Method: Solution dyed.
   4. Gage: 1/12 minimum.
   5. Pile Density: 6,720 oz/cy (+/- 5% industry standard).
   6. Surface Pile Weight: 28 oz./sq. yd. minimum.
   7. Size: Approximately 19.69" by 19.69".
   8. Backing System: As recommended by Manufacturer.
   9. Color(s): As selected by Architect from Manufacturer's full line of color options.

2.4 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided by or recommended by carpet manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, antimicrobial agent, non-staining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and that is recommended by carpet manufacturer.
   1. VOC Limits: ASTM D5116 Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products for carpet and adhesives.
   2. Adhesive: Water-resistant, mildew-resistant, non-staining, pressure-sensitive type to suit products and subfloor conditions indicated; that complies with flammability requirements for installed carpet and recommend by carpet manufacturer for releasable installations.

2.5 FLOOR ACCESSORIES

A. Vinyl Transitions:
   1. Description: Transitions, reducer, edge strips and adaptors strips as required to accommodate edge conditions and joints between different flooring materials
   2. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
      a. Johnsonite.
         1) Basis of Design Product: “Slim Line Reducer/Edge Strip”
   3. Profile and Dimensions: Provide profiles to fit conditions and as recommended by flooring installer unless indicated otherwise. Profile and width of height required to protect exposed edge of carpet and provide transition to adjacent materials, and of maximum lengths to minimize running joints. Final Selection shall be as approved by the Architect.
   4. Locations: Provide at transition between floor types and at edges of floor covering that would otherwise be exposed unless indicated otherwise.
   5. Colors and Patterns: As selected by Architect from full range of industry colors.

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PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Verify that substrates and conditions are satisfactory for carpet installation and comply with requirements specified.

B. Moisture Vapor Emission Test: Perform tests so that each test area does not exceed 1000 sq. ft. and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas and as indicated below:

1. 1. Anhydrous Calcium Chloride Test: Conduct test in accordance with the current version of ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb. of water/1000 sq. ft. in 24 hours, however, not to exceed manufacturer’s requirements.
2. 2. Relative Humidity Test: Testing for internal relative humidity of concrete slabs. Conduct test in accordance with current version of ASTM F2170 using in in-situ probes. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement, not to exceed manufacturer’s requirements.
3. 3. Testing for Alkalinity: Testing the PH at the surface must be conducted in accordance with the current version of ASTM F710, not to exceed manufacturer’s standards.
4. 4. Perform additional moisture tests recommended in writing by adhesive and flooring manufacturers. Proceed with installation only after substrates pass testing.

3.2 PREPARATION

A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and carpet manufacturer's written installation instructions for preparing substrates indicated to receive carpet installation.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet manufacturer.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. General: Comply with CRI 104, Section 13, "Carpet Modules (Tiles)."

B. Installation Method: As recommended in writing by carpet manufacturer, with non-directional units and merge-able dyelots.

C. Apply carpet adhesives by roller or spray method over entire surface to receive carpet, in accordance with carpet manufacturer’s instructions. Allow adhesive to set and/or dry before initiation of carpet installation, per carpet manufacturer’s instructions.

D. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.

E. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

1. Where carpeting does not continue beyond a door to another room, extend carpet into door reveals so that carpet stops under door when door is in closed position.

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F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, non-staining marking device.

G. Install pattern parallel to walls and borders to comply with CRI, "Patterned Carpet Installations" and with carpet manufacturer's written recommendations and as indicated by the Architect.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet:
   1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet manufacturer.
   2. Remove yarns that protrude from carpet surface.
   3. Vacuum carpet using commercial machine with face-beater element.

B. Protect installed carpet to comply with CRI 104, Section 15, and “Protection of Indoor Installations.”

C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer and as required by CRI, Protecting Indoor Installations.

3.5 INDOOR AIR QUALITY

A. Temporary ventilation: Provide temporary ventilation as specified – Indoor Air Quality (IAQ) Management, and as follows:

B. Ventilate products prior to installation. Remove from packaging and ventilate in a secure, dry, well-ventilated space free from strong contaminant sources and residues. Provide a temperature range of 60 degrees Fahrenheit (15.56 degrees Celsius) minimum to 90 degrees Fahrenheit (32.22 degrees Celsius) maximum continuously for minimum 72 hours. Do not ventilate within limits of Work unless otherwise approved by Architect.

END OF SECTION

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SECTION 09 84 00 - SOUND ABSORBING WALL UNITS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, materials, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Acoustical wall panels (AWP-1, AWP-2, AWP-3).

1.3 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.

B. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2023, with Editorial Revision (2024).

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

D. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.

E. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements, for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 - Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 - Product Requirements for substitution procedures.

C. Product Data: For each type of fabric facing, panel edge, core material, and mounting indicated.

D. Drawings:
   1. Shop Drawings: Include elevations, panel sizes, direction of fabric weave, pattern matching, mounting devices and details; details at panel head, base, joints, and corners; and details at ceiling, floor base, and wall intersections. Indicate panel edge and core materials.
   2. Coordination Drawings: Elevations and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
      a. Electrical outlets, switches, and thermostats.
      b. Items penetrating or covered by fabric-wrapped wall panels including, lighting fixtures, switches, and miscellaneous devices.
      c. Show operation of hinged and sliding components covered by or adjacent to fabric-wrapped wall panels.

E. Samples: For the following products, prepared on Samples of size indicated below:
   1. Fabric: Full-width by approximately 24-inch long Sample, but not smaller than required to show complete pattern repeat, from dye lot to be used for the Work, and with specified treatments applied. Mark top and face of fabric.

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2. Panel Edge: 12-inch long Sample(s) showing each edge profile, corner, and finish.
3. Core Material: 12-inch square Sample at corner.
4. Mounting Devices: Full-size Samples.
5. Assembled Panels: Approximately 24 by 24 inches, including joints and mounting methods.

F. Product Certificates: For each type of fabric-wrapped wall panel from manufacturer.

G. Warranty: Sample of special warranty.

H. Maintenance Material Submittals:
1. Maintenance Data: For fabric-wrapped wall panels to include in maintenance manuals. Include fabric manufacturers' written cleaning and stain-removal recommendations.
2. Attic stock:
a. Furnish extra materials from same production run that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1) Fabric: For each fabric, color, and pattern installed, provide length equal to 10 percent of amount installed, but no fewer than 10 yards.
2) Mounting Devices: Full-size units equal to 5 percent of amount installed, but no fewer than five devices, including unopened adhesives.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain fabric-wrapped wall panels from single source from single manufacturer.

B. Fire-Test-Response Characteristics: Provide fabric-wrapped wall panels meeting the following as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
1. Surface-Burning Characteristics: As determined by testing per ASTM E 84.
a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 450 or less.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with fabric and fabric-wrapped, wall panel manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.

B. Deliver materials and panels in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install fabric-wrapped wall panels until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Air-Quality Limitations: Protect fabric-wrapped wall panels from exposure to airborne odors such as tobacco smoke and install panels under conditions free from odor contamination of ambient air.

C. Field Measurements: Verify locations of fabric-wrapped wall panels and actual dimensions of openings and penetrations by field measurements before fabrication.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fabric-wrapped wall panels that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:

a. Fabric sagging, distorting, or releasing from panel edge.
b. Warping of core.

2. Warranty Period: Two (2) years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
1. Panels: Armstrong World Industries: www.armstrong.com
2. Fabric: Guilford of Maine: www.guilfordofmaine.com

B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
1. AVL Systems, Inc.
2. Conwed Designscape.
3. Golterman & Sabo.
4. Carnegie.

2.2 FABRIC-WRAPPED WALL PANELS (AWP-1, AWP-2, AWP-3)

A. Fabric-Wrapped Acoustical Wall Panel: Manufacturer's standard panel construction consisting of facing material stretched over front face, edges, and back border of dimensionally stable edge-framed core, with rigid edges to reinforce panel perimeter against warpage and damage. Fabric to be bonded or attached to edges and back of frame.

B. Panels:
1. Mineral-Fiber Board Cores: Fiberglass core material (6 PCF)
a. Panel thickness: 2"
b. NRC: 0.80 per inch minimum.
2. Panels shall have square edges and be furnished with continuous chemically hardened internal edge protection.
3. Size: As indicated on Drawings.
4. Corners: Square.

C. Fabric:
1. Basis of Design Product: Refer to "Finish Color Summary Chart" on Drawings for product selections.
2. Provide fabric covering the face, all edges, and a return on panel backside of a minimum of 1-1/2".
3. All fabric shall be treated with manufacturer’s standard anti-microbial treatment.
4. Color: As indicated on Drawings.

D. Mounting Z-clips.

E. All components utilized in the construction of these wall panels shall meet Class A (0-25) rating per ASTM E84, fuel contribution of 20, and smoke density value of 65.

2.3 FABRICATION

A. General: Use manufacturer's standard construction except as otherwise indicated; with facing material applied to face, edges, and back border of dimensionally stable core; and with rigid edges to reinforce panel perimeter against warpage and damage.

B. Mineral-Fiber Board Cores: Chemically harden core edges and areas of core where mounting devices are attached.

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1. Core-Face Layer: Evenly stretched over core face and edges and securely attached to core; free from puckers, ripples, wrinkles, or sags.
2. Facing Material:
   a. Apply fabric fully covering visible surfaces of panel; with material stretched straight, on the grain, tight, square, and free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other visible distortions or foreign matter.
   b. Fabrics with Directional or Repeating Patterns or Directional Weave: Mark fabric top and attach fabric in same direction so pattern or weave matches in adjacent panels.
3. Dimensional Tolerances of Finished Panels: Plus or minus 1/16 inch for the following:
   a. Thickness.
   b. Edge straightness.
   c. Overall length and width.
   d. Squareness from corner to corner.
   e. Chords, radii, and diameters.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine fabric, fabricated panels, substrates, areas, and conditions, for compliance with requirements, installation tolerances, and other conditions affecting performance of fabric-wrapped wall panels.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install fabric-wrapped wall panels in locations indicated with vertical surfaces and edges plumb, top edges level and in alignment with other panels, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.

B. Comply with fabric-wrapped, wall panel manufacturer's written instructions for installation of panels using type of mounting devices indicated. Mount panels securely to supporting substrate.

C. Align and level fabric pattern and grain among adjacent panels.

3.3 INSTALLATION TOLERANCES

A. Variation from Plumb and Level: Plus or minus 1/16 inch (1.59 mm).

B. Variation of Panel Joints from Hairline: Not more than 1/16 inch (1.59 mm) wide.

3.4 CLEANING

A. Clip loose threads; remove pills and extraneous materials.

B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION

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SECTION 09 91 13 - EXTERIOR PAINTING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Exterior paint and coating systems.

1.3 REFERENCE STANDARDS

A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2024.

B. ASTM D3359 - Standard Test Methods for Rating Adhesion by Tape Test; 2023.

C. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings; 2025.

D. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020.

E. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

F. REFERENCES

G. ASTM D16 – Definitions of Terms Relating to Paint, Varnish, Lacquer, and Related Products.

H. ASTM D3359 – Standard Test Methods for Measuring Adhesion by Tape Test.

I. ASTM D4442-92 – Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood Base Materials.

J. EPA – Method 24.

K. GS-11, GC-03.

L. NACE International (National Association of Corrosion Engineers) – Industrial Maintenance Painting.

M. NPCA (National Paint and Coatings Association) – Guide to U.S. Government Paint Specifications.

N. Paint – Certified Product List - Florida Department of Agriculture and Consumer Services.

O. PDCA (Painting and Decorating Contractors of America) – Architectural Painting Specifications Manual.

P. PDCA Standard P1-04 Touchup Painting and Damage Repair; Financial Responsibility.

Q. PDCA Standard P5-04 Benchmark Sample Procedures for Paint and other Decorative Coating System.

R. SSPC (Steel Structures Painting Council) – Steel Structures Painting Manual.

S. SSPC-SP 1 – Solvent Cleaning.

T. Modern Guide to Paint Specifications (current edition) – Standard Type 1.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements, for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this section.

1.6 SUBMITTALS

A. Refer to Section 01 30 00.0 - Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 - Product Requirements for substitution procedures.

C. Product Data: For each type of product:
   1. Product characteristics
   2. Surface preparation instructions and recommendations
   3. Primer requirements and finish specifications
   4. Storage and handling requirements
   5. Application methods
   6. Cautions and VOC levels, certification from manufacturer that products comply with local regulations controlling volatile organic compounds (VOC's).
   7. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
   8. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

D. Samples:
   1. Submit a complete set of color chips representing the full range of manufacturer’s color samples available.
   2. Submit two 9" x 9" samples illustrating selected colors and textures for each type.

E. Closeout Documents:
   1. Coating Maintenance Manual: Upon conclusion of the project, the Contractor or paint manufacturer/supplier shall furnish a coating maintenance manual, such as “Custodian Project Color and Product Information” by Sherwin-Williams or equal. Manual shall include an Area Summary with finish schedule designating where each product/color/finish was used. It shall also include care and Cleaning instructions, touch up procedures, and a Product Data Sheet for each product used.

1.7 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum 5-years documented experience.

B. Applicator: Company specializing in performing the work of this section with minimum 5-years documented experience.

C. Existing Coatings: The manufacturer’s representation shall visit the site to confirm acceptability of existing surfaces to receive paint and make recommendations to specified paint systems to obtain proper compatibility.

1.8 PERFORMANCE REQUIREMENTS

A. Conform to applicable code for flame and smoke rating requirements for finishes.

B. Painting manufacturer and Contractor shall conform to Federal Rules and Regulations, Vol. 63, No. 176, September 11, 1998, State and local VOC (Volatile Organic Compound) Regulations in area where Project is located. Notify Architect in writing if variations to Specifications herein are required.
   1. VOC content shall be a maximum 350 gm/liter, unless noted otherwise.

C. VOC Content: Determine VOC (Volatile Organic Compound) content of solvent borne and waterborne paints and related coatings in accordance with EPA Method 24 or ASTM D3960.

1.9 MOCKUPS

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

B. Architect will select one surface to represent surfaces and conditions for application of each paint system.

C. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. and at exterior inside and outside corner.

D. Other Items: Architect will designate items or areas required.

E. Final approval of color selections will be based on mockups.

F. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

G. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

H. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.10 PRE-INSTALLATION MEETING

A. The contractor shall conduct a pre-installation meeting at the project site a minimum of 30 days prior to any work being installed as indicated in this section and other related sections that require coordination with this section.

B. The paint manufacturer's representative shall review the painting systems with the Construction manager, Architect, and painting Contractor.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 degrees Fahrenheit (7.22 degrees Celsius).
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

B. Storage:
   1. Store paint materials in a properly ventilated area at the temperature range required by the manufacturer.
   2. Store and dispose of solvent-based materials and materials used with solvent-based materials in accordance with manufacturer's and other regulating authorities having jurisdiction.

1.12 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 degrees Fahrenheit (35 degrees Celsius).

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 degrees Fahrenheit (-15 degrees Celsius) above the dew point; or to damp or wet surfaces.

1.13 ATTIC STOCK

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

B. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.14 WARRANTY

A. Contractor shall provide five (5) year warranty against defects in labor and installation of paint materials in the form indicated at the end of this section.

B. Manufacturer shall provide five (5) year warranty against defects in all paint products and materials incorporated into the work.

C. The manufacturer shall assume all responsibility for substrate acceptance and adhesion and to uphold the required warranty.

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PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
   1. The painting schedule is based on products manufactured by the Sherwin-Williams Company.

B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
   1. Benjamin Moore & Co.
   2. Florida Paint.

2.2 COMPATIBILITY

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists.

B. Paint materials and equipment shall be compatible in use; finish coats shall be compatible with prime coats; prime coats shall be compatible with the surface to be coated; tools and equipment shall be compatible with the coating to be applied.
   1. Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristic of finish materials to ensure use of compatible primers.
   2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

C. Adhesion Test: Provide adhesion X-cut and tape test for primer adhesion per ASTM D3359 for every 200 s.f. of primed area.

D. Thinners, when used, shall be only those thinners recommended for that purpose by the manufacturer of the material to be thinned.

E. The term "paint," as used herein, includes enamels, paints, sealers, stains, fillers, emulsions, and other coatings, whether used as prime, intermediate, or finish coats.

2.3 ACCEPTANCE OF SPECIFICATION

A. By submitting a proposal, the Contractor has reviewed the bidding documents with the painting subcontractor and accepts the Specifications as sufficient to produce approved painting results. If the painting subcontractor contends that the materials or number of coats specified will not produce satisfactory results, he shall so notify the Architect directly or indirectly through a Bidding Contractor 14 days prior to receipt of bids for proper action.

B. The type of material to be used and the number of coats to be applied are listed in the "Painting Schedule" of this section of these specifications. Also refer to Room Finish Schedule.
   1. Paint exposed surfaces whether or not colors are designated in schedules, except where a surface or material is specifically indicated not to be painted or is to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, the Architect will select from standard colors or finishes available.
   2. The Architect shall not be limited in the number of colors selected for single space or for the complete Project.
   3. The architect shall make the final selection of the finish sheen.

2.4 PAINTING SCHEDULE

A. Concrete (Cast-In Place, Precast Concrete)

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1. Latex Systems
    a. Gloss Finish
        1) 1st Coat: S-W Loxon Concrete & Masonry Primer Sealer, LX02W50 (3.2-dry) – MPI#3
        2) 2nd Coat: S-W A-100 Exterior Latex Gloss, A8W150 Series – MPI#11
        3) 3rd Coat: S-W A-100 Exterior Latex Gloss, A8W150Series (1.3-mil dry per coat)
    b. Semi-Gloss Finish
        1) 1st Coat: S-W Loxon Concrete & Masonry Primer Sealer, LX02W50 (3.2-dry) – MPI#3
        2) 2nd Coat: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66W1150 – MPI#153
        3) 3rd Coat: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66W1150 (2.5-4.0-mil dry per coat)
    c. Satin Finish
        1) 1st Coat: S-W Loxon Concrete & Masonry Primer Sealer, LX02W50 (3.2-dry) – MPI#3
        2) 2nd Coat: S-W SuperPaint Acrylic Satin, A89 Series – MPI#15
        3) 3rd Coat: S-W SuperPaint Acrylic Satin, A89 Series (1.4-mil dry per coat)
            (a) Cement Plaster and Cementitious Siding
2. Latex Systems
    a. Gloss Finish
        1) 1st Coat: S-W Loxon Concrete & Masonry Primer Sealer, LX02W50 (3.2-dry) – MPI#3
        2) 2nd Coat: S-W A-100 Exterior Latex Gloss, A8W150 Series – MPI#11
        3) 3rd Coat: S-W A-100 Exterior Latex Gloss, A8W150Series (1.3-mil dry per coat)
    b. Semi-Gloss Finish
        1) 1st Coat: S-W Loxon Concrete & Masonry Primer Sealer, LX02W50 (3.2-dry) – MPI#3
        2) 2nd Coat: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66W1150 – MPI#153
        3) 3rd Coat: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66W1150 (2.5-4.0-mil dry per coat)
    c. Satin Finish
        1) 1st Coat: S-W Loxon Concrete & Masonry Primer Sealer, LX02W50 (3.2-dry) – MPI#3
        2) 2nd Coat: S-W SuperPaint Acrylic Satin, A89 Series – MPI#15
        3) 3rd Coat: S-W SuperPaint Acrylic Satin, A89 Series (1.4-mil dry per coat)

B. Synthetic Stucco
1. Latex Systems
    a. Gloss Finish
        1) 1st Coat: S-W Loxon Concrete & Masonry Primer Sealer, LX02W50 – MPI#3
        2) 2nd Coat: S-W A-100 Exterior Latex Gloss, A8W150 Series – MPI#11
        3) 3rd Coat: S-W A-100 Exterior Latex Gloss, A8W150 Series (1.3-mil dry per coat)
    b. Semi-Gloss Finish
        1) 1st Coat: S-W Loxon Concrete & Masonry Primer Sealer, LX02W50 – MPI#3
        2) 2nd Coat: S-W - Pro Industrial Acrylic Semi-Gloss Coating, B66W1150 Series (2.5-4.0-mil dry per coat) - MPI #153
        3) 3rd Coat: S-W - Pro Industrial Acrylic Semi-Gloss Coating, B66W1150 Series (2.5-4.0-mil dry per coat)
    c. Flat Finish
        1) 1st Coat: S-W Loxon Concrete & Masonry Primer Sealer, LX02W50 – MPI#3
        2) 2nd Coat: S-W A-100 Exterior Latex Flat, A6 Series - MPI #10

3) 3rd Coat: S-W A-100 Exterior Latex Flat, A6 Series (1.4-mil dry per coat)

C. Masonry (CMU, Split-Face, Scored, Smooth, High-Density, Low- Density, Fluted)
1. Latex Systems
a. Gloss Finish
1) 1st Coat: S-W Pro Industrial Heavy-Duty Block Filler, B42W150 (8-10.5mil dry) – MPI#4 X-Green
2) 2nd Coat: S-W A-100 Exterior Latex Gloss, A8W150 Series – MPI#11
3) 3rd Coat: S-W A-100 Exterior Latex Gloss, A8W150 Series (1.3-mil dry per coat)
b. Semi-Gloss Finish
1) 1st Coat: S-W Pro Industrial Heavy-Duty Block Filler, B42W150 (8-10.5mil dry) - MPI#4 X-Green
2) 2nd Coat: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66W1150 Series – MPI#153
3) 3rd Coat: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66W1150 Series (2.5-4.0-mil dry per coat)
c. Satin Finish
1) 1st Coat: S-W Pro Industrial Heavy-Duty Block Filler, B42W150 (8-10.5mil dry) - MPI#4 X-Green
2) 2nd Coat: S-W SuperPaint Acrylic Satin, A89 Series – MPI#15
3) 3rd Coat: S-W SuperPaint Acrylic Satin, A89 Series (1.4-mil dry per coat)

D. Metal – (Aluminum, Galvanized)
1. Latex Systems
a. Gloss Finish
1) 1st Coat: S-W Pro Industrial Pro-Cryl® Universal Primer, B66W1300 Series (5.0 - 10.0-mil dry) – MPI#107
2) 2nd Coat: S-W Pro Industrial DTM Acrylic Gloss Coating, B66W1050 Series – MPI#114
3) 3rd Coat: S-W Pro Industrial DTM Acrylic Gloss Coating, B66W1050 Series (2.5 - 4.0-mil dry per coat)
b. Semi-Gloss Finish
1) 1st Coat: S-W Pro Industrial Pro-Cryl® Universal Primer, B66W1300 Series (5.0 -10.0-mil dry) – MPI#107
2) 2nd Coat: S-W Pro Industrial DTM Acrylic Semi-Gloss Coating, B66W1150 Series - MPI#114
3) 3rd Coat: S-W Pro Industrial DTM Acrylic Semi-Gloss Coating, B66W1150 Series (2.5 - 4.0-mil dry per coat)

E. Metal – (Misc. Iron, Ornamental Iron, Structural Iron, Ferrous Metal)
1. Latex Systems
a. Gloss Finish
1) 1st Coat: S-W Pro Industrial Pro-Cryl® Universal Primer, B66W1300 Series (2.0 - 4.0-mil dry) – MPI#107
2) 2nd Coat: S-W Pro Industrial DTM Acrylic Gloss Coating, B66W1050 Series - MPI#114
3) 3rd Coat: S-W Pro Industrial DTM Acrylic Gloss Coating, B66W1050 Series – (2.5 - 4.0-mil dry per coat)
b. Semi-Gloss Finish
1) 1st Coat: S-W Pro Industrial Pro-Cryl® Universal Primer, B66W1300 Series (2.0 - 4.0-mil dry) – MPI#107
2) 2nd Coat: S-W Pro Industrial DTM Acrylic Semi-Gloss Coating, B66W1150 Series – MPI#114

3) 3rd Coat: S-W Pro Industrial DTM Acrylic Semi-Gloss Coating, B66W1150 Series (2.5 - 4.0-mil dry per coat)

F. Drywall (Gypsum Board, Exterior Drywall)
1. Latex Systems
a. Gloss Finish
1) 1st Coat: S-W Multipurpose Latex Primer/Sealer, B51-450 Series (1.4-mil dry) – MPI#17
2) 2nd Coat: S-W A-100 Exterior Latex Gloss, A8W150 Series – MPI#11
3) 3rd Coat: S-W A-100 Exterior Latex Gloss, A8W150 Series (1.3-mil dry per coat)
b. Semi-Gloss Finish
1) 1st Coat: S-W Multipurpose Latex Primer/Sealer, B51-450 Series (1.4-mil dry) – MPI#17
2) 2nd Coat: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66W1150 Series – MPI#153
3) 3rd Coat: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66W1150 Series (2.5-4.0-mil dry per coat)

2.5 MATERIALS – GENERAL REQUIREMENTS

A. Paints and Coatings – General:
1. Unless otherwise indicated, provide factory-mixed coatings.
2. When required, mix coatings to correct consistency in accordance with manufacturer's instructions before application.
3. Do not reduce, thin, or dilute coatings or add materials to coatings unless approved in manufacturer's product instructions.
4. Confirm VOC’s need by using the products MSDS sheets.

B. Primers: Where the manufacturer offers options on primers for a particular substrate, use primer categorized as “best” by the manufacturer.

2.6 ACCESSORIES

A. Coating application accessories: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required, per manufacturer’s specifications.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows (Do not apply finishes unless moisture content of surfaces is below the following maximums):
1. Concrete: 12 percent
2. Masonry (Clay and CMUs): 12 percent
3. Gypsum Board: 12 percent
4. Plaster: 12 percent

C. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected.
1. Application of coating indicates acceptance of surfaces and conditions.

E. Do not begin application of coatings until substrates have been properly prepared; notify Owner’s Representative of unsatisfactory conditions before proceeding.

F. If substrate preparation is the responsibility of another installer, notify Owner’s Representative of unsatisfactory preparation before proceeding.

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G. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint film.

H. Test shop applied primer for compatibility with subsequent cover materials.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

C. The surface shall be dry and in sound condition. Remove all oil, dust, dirt, loose rust, peeling paint, or other contamination to ensure good adhesion.

D. Provide barrier coats over incompatible primers or remove and re-prime. Notify Architect in writing about anticipated problems using the specified finish coat material with substrates primed by others.

E. Impervious Surfaces:
   1. Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach.
   2. Rinse with clean water and allow surface to dry.
   3. Aluminum Surfaces:
      a. Remove all oil, grease, dirt, oxide, and other foreign material by cleaning per SSPC-SP 1 Solvent Cleaning.
   4. Block/Unit Masonry (Cinder and Concrete):
      a. Remove all loose mortar and foreign material.
   5. Surface must be free of laitance, concrete dust, dirt, form release agents, moisture curing membranes, loose cement, and hardeners.
   6. Let concrete and mortar cure at least 30 days at 75°F unless the manufactures products are designed for application prior to the 30-day period.
   7. The pH of the surface and moisture content must be in accordance with the paint manufacturer’s recommendations prior to painting.
   8. Concrete:
      a. Remove contamination by washing with an appropriate cleaner, rinse thoroughly.
   9. The pH of the surface and moisture content shall be in accordance with the paint manufacturer’s recommendations prior to painting.
   10. Allow the surface to thoroughly dry.
   11. Clean concrete floor surfaces scheduled to be painted with a commercial solution of muriatic acid or other etching cleaner. Flush floor with clean water to neutralize acid and allow to dry before painting.
   12. Fill bug holes, air pockets, and other voids under another section with a cement-patching compound of sufficient cohesive strength to support the specified coating system.
   13. Shall be clean, dry and all dust removed prior to painting.
   14. All nail heads must be set and spackled.
   15. Tape all joints and cover with a joint compound.
   16. Spackled nail heads and tape joints shall be sanded smooth.
   17. Clean per SSPC-SP 1 using detergent and water or a degreasing cleaner to remove greases and oils.
   18. Apply a test area, priming as required.
   19. Allow the coating to cure in accordance with the manufacturer’s recommendation before testing.
   20. Perform adhesion tests in accordance with ASTM 3359 Adhesion by Tape Test.

21. If adhesion is poor, then notify Owner's representative that additional surface preparation under another section is necessary to remove pre-treatments or contaminants that interfere with adhesion of the coating.
22. Shall allow to thoroughly dry for at least 30 days before painting unless the manufacturer's products are designed for application prior to the 30-day period.
23. Bare plaster must be cured and hard prior to painting.
24. Correct any soft, porous, or powdery plaster per requirements under another section of the specifications.
25. Check other sections for additional surface preparation and shop priming of bare steel surfaces.
26. Surface preparation shall include appropriate SSPC recommended methods.
    a. Shop primer shall be compatible with the field-applied coatings.
    b. Surfaces shall be dry and clean prior to the application of field-applied coatings.
    c. Remove all contaminants in accordance with SSPC-SP 1 Solvent Cleaning or SSPC Method recommended for condition of substrate.

F. Materials Preparation:
    1. Mix and prepare painting materials in accordance with manufacturer's directions.

G. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing, and application of paint in a clean condition, free of foreign materials and residue.

H. Stir materials before application to produce a mixture of uniform density and stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.

I. Use only thinners approved by the paint manufacturer and only within recommended limits.

J. Tinting: Tint each undercoat of lighter shade to facilitate identification of each coat where multiple coats of the same materials are applied. Tint undercoats to match the color of the finish coat but provide sufficient differences in shade of undercoats to distinguish each separate coat.

K. Surface preparation, priming, and finish coats specified in this section are in addition to shop priming surface treatment specified under other sections.

L. Preparation and testing of existing painted surfaces, indicated to be repainted to accommodate new work, shall be performed as work of this section.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

B. Use applicators and techniques suited for paint and substrate indicated.
    1. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
    2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
    3. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
    4. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat but provide sufficient difference in shade of undercoats to distinguish each separate coat.
    5. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
    6. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
    7. Apply paint in a cross-hatch application to achieve an even coverage.

3.4 FIELD QUALITY CONTROL

A. The right is reserved by Owner/Architect to invoke the following material testing procedure in addition to other tests indicated when and as often as he deems necessary during the period of field painting.

B. Engage services of an independent testing laboratory to sample paint being used. Samples of materials delivered to project site will be taken, identified and sealed, and certified in presence of Contractor.

C. Testing laboratory will perform appropriate tests for one or each of the following characteristics: Abrasion resistance, apparent reflectivity, flexibility, washability, absorption, accelerated weathering, dry opacity, accelerated yellowness, recoating, skinning, color retention, alkali resistance, and quantitative materials analysis.
   1. A test patch for applied paint adhesion may be required.
   2. 1. Adhesion text shall provide the adhesion X-cut and tape test for adhesion per ASTM D3359 for areas selected by the Architect.
   3. 2. Areas found to be defective shall be have paint removed and repainting shall be provided.
   4. 3. Owner/Architect may require retesting.

D. A test patch for adhesion may also be required. The procedure for the test patch is as follows:
   1. An area that represents the worst condition of the existing paint is selected.
   2. The surface is prepared as appropriate for the repaint work.
   3. The new coating or coating system is applied.
   4. The coating is allowed to cure for at least 7 days at 75 degrees Fahrenheit (23.89 degrees Celsius). or according to the coating manufacturer's instructions.
   5. After proper curing the adhesion is tested using an acceptable method such as the Adhesion by Tape Test (ASTM D 3359).

E. If test results show that material being used does not comply with specified requirements, Contractor may be directed to stop painting work, and remove noncomplying paint; pay for testing; repaint surfaces coated with rejected paint; remove rejected paint from previously painted surfaces if, upon repainting with specified paint, the 2 coatings are noncompatible.

3.5 EQUIPMENT

A. Paint the following work where exposed.

B. Uninsulated metal and plastic piping.

C. Pipe hangers and supports.

D. Metal and plastic conduit.

3.7 CLEAN-UP AND PROTECTION

A. Upon completion of painting work, clean window glass and other paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

B. Provide "Wet Paint" signs as required to protect newly painted finishes.

C. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

D. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

E. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

F. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

4.2 TOUCH-UP AND DAMAGE REPAIR

A. Contractor shall repair all deficiencies in coating application in accordance with PDCA Standard P1-04.

B. Inform Owner's representative of all damage to properly painted surfaces and receive authorization prior to performing damage repair.

END OF SECTION

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SECTION 09 91 23 - INTERIOR PAINTING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Interior paint and coating systems.

1.3 REFERENCE STANDARDS

A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2024.

B. ASTM D3359 - Standard Test Methods for Rating Adhesion by Tape Test; 2023.

C. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings; 2025.

D. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020.

E. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

F. EPA – Method 24.

G. GS-11, GC-03.

H. NACE International (National Association of Corrosion Engineers) – Industrial Maintenance Painting.

I. NPCA (National Paint and Coatings Association) – Guide to U.S. Government Paint Specifications.

J. Paint – Certified Product List - Florida Department of Agriculture and Consumer Services.

K. PDCA (Painting and Decorating Contractors of America) – Architectural Painting Specifications Manual.

L. PDCA Standard P1-04 Touchup Painting and Damage Repair; Financial Responsibility.

M. PDCA Standard P5-04 Benchmark Sample Procedures for Paint and other Decorative Coating System.

N. SSPC (Steel Structures Painting Council) – Steel Structures Painting Manual.

O. SSPC-SP 1 – Solvent Cleaning.

P. Modern Guide to Paint Specifications (current edition) – Standard Type 1.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements, for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this section.

1.6 SUBMITTALS

A. Refer to Section 01 30 00.0 - Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 - Product Requirements for substitution procedures.

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C. Product Data: For each type of product:
   1. Product characteristics
   2. Surface preparation instructions and recommendations
   3. Primer requirements and finish specifications
   4. Storage and handling requirements
   5. Application methods
   6. Cautions and VOC levels, certification from manufacturer that products comply with local regulations controlling volatile organic compounds (VOC's).
   7. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
   8. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

D. Samples:
   1. Submit a complete set of color chips representing the full range of manufacturer’s color samples available.
   2. Submit two 9" x 9" samples illustrating selected colors and textures for each type.

E. Closeout Documents:
   1. Coating Maintenance Manual: Upon conclusion of the project, the Contractor or paint manufacturer/supplier shall furnish a coating maintenance manual, such as “Custodian Project Color and Product Information” by Sherwin-Williams or equal. Manual shall include an Area Summary with finish schedule designating where each product/color/finish was used. It shall also include care and Cleaning instructions, touch up procedures, and a Product Data Sheet for each product used.

1.7 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum 5-years documented experience.

B. Applicator: Company specializing in performing the work of this section with minimum 5-years documented experience.

1.8 PERFORMANCE REQUIREMENTS

A. Conform to applicable code for flame and smoke rating requirements for finishes.

B. Painting manufacturer and Contractor shall conform to Federal Rules and Regulations, Vol. 63, No. 176, September 11, 1998, State and local VOC (Volatile Organic Compound) Regulations in area where Project is located. Notify Architect in writing if variations to specifications herein are required.
   1. VOC content shall be a maximum 350 gm/liter, unless noted otherwise.

C. VOC Content: Determine VOC (Volatile Organic Compound) content of solvent borne and waterborne paints and related coatings in accordance with EPA Method 24 or ASTM D3960.

1.9 MOCKUPS

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

B. Architect will select one surface to represent surfaces and conditions for application of each paint system.
   1. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. and at exterior inside and outside corner.
   2. Other Items: Architect will designate items or areas required.

C. Final approval of color selections will be based on mockups.

1. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

D. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

E. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.10 PRE-INSTALLATION MEETING

A. The Contractor shall conduct a pre-installation meeting at the project site a minimum of 30 days prior to any work being installed as indicated in this section and other related sections that require coordination with this section.

B. The paint manufacturer's representative shall review the painting systems with the Construction Manager, Architect, and painting Contractor.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 degrees Fahrenheit (7.22 degrees Celsius).
   1. 1. Maintain containers in clean condition, free of foreign materials and residue.
   2. 2. Remove rags and waste from storage areas daily.

B. Storage:
   1. Store paint materials in a properly ventilated area at the temperature range required by the manufacturer.
   2. Store and dispose of solvent-based materials and materials used with solvent-based materials in accordance with manufacturer's and other regulating authorities having jurisdiction.

1.12 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 degrees Fahrenheit (35 degrees Celsius).

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 degrees Fahrenheit (-15 degrees Celsius) above the dew point; or to damp or wet surfaces.

C. Provide lighting level of 80 foot (2438.4 cm)-candles measured mid-height at substrate surface.

1.13 ATTIC STOCK

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.14 WARRANTY

A. Contractor shall provide five (5) year warranty against defects in labor and installation of paint materials in the form indicated at the end of this section.

B. Manufacturer shall provide five (5) year warranty against defects in all paint products and materials incorporated into the work.

C. The manufacturer shall assume all responsibility for substrate acceptance and adhesion and to uphold the required warranty.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with

Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.

1. The painting schedule is based on products manufactured by the Sherwin-Williams Company.

B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
   1. Benjamin Moore & Co.
   2. Florida Paint

2.2 COMPATIBILITY

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists.

B. Paint materials and equipment shall be compatible in use; finish coats shall be compatible with prime coats; prime coats shall be compatible with the surface to be coated; tools and equipment shall be compatible with the coating to be applied.
   1. Review other sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristic of finish materials to ensure use of compatible primers.
   2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

C. Adhesion Test: Provide adhesion X-cut and tape test for primer adhesion per ASTM D3359 for every 200 s.f. of primed area.

D. Thinners, when used, shall be only those thinners recommended for that purpose by the manufacturer of the material to be thinned.

E. The term "paint," as used herein, includes enamels, paints, sealers, stains, fillers, emulsions, and other coatings, whether used as prime, intermediate, or finish coats.

2.3 ACCEPTANCE OF SPECIFICATION

A. By submitting a proposal, the Contractor has reviewed the bidding documents with the painting subcontractor and accepts the Specifications as sufficient to produce approved painting results. If the painting subcontractor contends that the materials or number of coats specified will not produce satisfactory results, he shall so notify the Architect directly or indirectly through a Bidding Contractor 14 days prior to receipt of bids for proper action.

B. The type of material to be used and the number of coats to be applied are listed in the "Painting Schedule" of this section of these specifications. Also refer to Room Finish Schedule.
   1. Paint exposed surfaces whether or not colors are designated in schedules, except where a surface or material is specifically indicated not to be painted or is to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, the Architect will select from standard colors or finishes available.
   2. The Architect shall not be limited in the number of colors selected for single space or for the complete Project.
   3. The Architect shall make the final selection of the finish sheen.

2.4 PAINTING SCHEDULE

A. Concrete (Walls, Ceilings, Poured, Precast, Cement Plaster, Cement Board, and Cast-In Place)
   1. Latex Systems
      a. Gloss Finish
         1) 1st Coat: S-W Loxon Concrete & Masonry Primer Sealer, LX02W50 (8-mil wet, 3.2-dry) – MPI #3
         2) 2nd Coat: S-W Pro Industrial Acrylic Gloss Coating, B66-600 Series – MPI #114

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3) 3rd Coat: S-W Pro Industrial Acrylic Gloss Coating, B66-600 Series, (2.5 - 4-mil dry per coat)

b. Semi-Gloss Finish
1) 1st Coat: S-W Loxon Concrete & Masonry Primer Sealer, LX02W50 (8-mil wet, 3.2-dry) – MPI #3
2) 2nd Coat: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series – MPI #153
3) 3rd Coat: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series (2.5 - 4-mil dry per coat)

c. Eggshell/Satin Finish
1) 1st Coat: S-W Loxon Concrete & Masonry Primer Sealer, LX02W50 (8-mil wet, 3.2-dry) – MPI #3S-W Pro Industrial Heavy-Duty Block Filler, B42W150 at 75-100 sq/gallon
2) 2nd Coat: S-W Harmony Low Odor Interior Latex Eg-Shel, B9 Series – MPI #144 X-Green
3) 3rd Coat: S-W Harmony Low Odor Interior Latex Eg-Shel, B9 Series (1.6-mil dry per coat)

d. Flat Finish – Ceilings Only
1) 1st Coat: S-W Loxon Concrete & Masonry Primer Sealer, LX02W50 (8-mil wet, 3.2-dry)
2) 2nd Coat: S-W Harmony Low Odor Interior Latex Flat, B5 Series
3) 3rd Coat: S-W Harmony Low Odor Interior Latex Flat, B5 Series (4-mil wet, 1.6-mil dry per coat)

2. Epoxy System (Water Base)
a. Gloss Finish
1) 1st Coat: S-W Pro Industrial Water Based Catalyzed Epoxy, B73-300/ B73V300 – MPI #254X-Green
2) 2nd Coat: S-W Pro Industrial Water Based Catalyzed Epoxy, B73-300/ B73V300 - (2.0 – 4.0-mil dry per coat)

b. Semi-Gloss Finish
1) 1st Coat: S-W Pro Industrial Water Based Catalyzed Epoxy Eg-Shel, B70/B60V25 – MPI #254X-Green
2) 2nd Coat: S-W Pro Industrial Water Based Catalyzed Epoxy Eg-Shel, B70/B60V25 - (2.0 – 4.0-mil dry per coat)

c. Eggshell/Satin Finish
1) 1st Coat: S-W Pro Industrial Water Based Catalyzed Epoxy Eg-Shel, B73-360 / B73V300 – MPI #254X-Green
2) 2nd Coat: S-W Pro Industrial Water Based Catalyzed Epoxy Eg-Shel, B73-360 / B73V300 - (2.0 – 4.0-mil dry per coat)

B. Masonry (CMU, Split-Face, Scored, Smooth, High-Density, Low- Density, Fluted)
1. Latex Systems
a. Gloss Finish
1) 1st Coat: S-W Pro Industrial Heavy-Duty Block Filler, B42W150 at 75-100 sq/gallon – MPI #4
2) 2nd Coat: S-W Pro Industrial Acrylic Gloss Coating, B66-600 Series – MPI #114
3) 3rd Coat: S-W Pro Industrial Acrylic Gloss Coating, B66-600 Series, (2.5 - 4-mil dry per coat)

b. Semi-Gloss Finish
1) 1st Coat: S-W Pro Industrial Heavy-Duty Block Filler, B42W150 at 75-100 sq/gallon – MPI#4
2) 2nd Coat: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series – MPI #114

3) 3rd Coat: S-W Pro Industrial Acrylic Semi-GlossGloss Coating, B66-650 Series (2.5 - 4-mil dry per coat)

c. Eggshell/Satin Finish
1) 1st Coat: S-W Pro Industrial Heavy-Duty Block Filler, B42W150 at 75-100 sq/gallon – MPI#4
2) 2nd Coat: S-W Harmony Low Odor Interior Latex Eg-Shel, B9 Series – MPI #144 X-Green
3) 3rd Coat: S-W Harmony Low Odor Interior Latex Eg-Shel, B9 Series (1.6-mil dry per coat)

2. Water Epoxy System (Water Base)
a. Gloss Finish
1) 1st Coat: S-W Pro Industrial Heavy-Duty Block Filler, B42W150 at 75-100 sq/gallon – MPI#4
2) 2nd Coat: Pro Industrial Water Based Catalyzed Epoxy, B73-300/ B73V300 – MPI #254X-Green
3) 3rd Coat: Pro Industrial Water Based Catalyzed Epoxy, B73-300/ B73V300 (2.0 – 4.0-mil dry per coat)

b. Semi-Gloss Finish
1) 1st Coat: S-W Pro Industrial Water Based Catalyzed Epoxy Eg-Shel, B70/B60V25 – MPI #254X-Green
2) 2nd Coat: S-W Pro Industrial Water Based Catalyzed Epoxy Eg-Shel, B70/B60V25 - (2.0 – 4.0-mil dry per coat)

c. Eg-Shel Finish
1) 1st Coat: S-W Pro Industrial Heavy-Duty Block Filler, B42W150 at 75-100 sq/gallon – MPI#4
2) 2nd Coat: S-W Pro Industrial Water Based Catalyzed Epoxy Eg-Shel, B73-360 / B73V300 – MPI #254X-Green
3) 3rd Coat: S-W Pro Industrial Water Based Catalyzed Epoxy Eg-Shel, B73-360 / B73V300 (2.0 – 4.0-mil dry per coat)

C. Metal – (Aluminum, Galvanized)
1. Latex Systems
a. Gloss Finish
1) 1st Coat: S-W Pro Industrial Pro-Cryl® Universal Primer, B66W1300 Series (2.0 – 4.0-mil dry per coat) – MPI #107
2) 2nd Coat: S-W Pro Industrial Acrylic Gloss Coating, B66-600 Series – MPI #114
3) 3rd Coat: S-W Pro Industrial Acrylic Gloss Coating, B66-600 Series Series (2.5 - 4.0-mil dry per coat)

b. Semi-Gloss Finish
1) 1st Coat: S-W Pro Industrial Pro-Cryl® Universal Primer, B66W1300 Series (2.0 – 4.0-mil dry per coat) – MPI #107
2) 2nd Coat: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series – MPI #153
3) 3rd Coat: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series (2.5 - 4.0-mil dry per coat)

c. Eg-Shel/Satin Finish
1) 1st Coat: S-W Pro Industrial Pro-Cryl® Universal Primer, B66W1300 Series (2.0 – 4.0-mil dry) – MPI#107
2) 2nd Coat: S-W Pro Industrial DTM Acrylic Eg-Shel Coating, B66W1250 Series – MPI #151X-Green
3) 3rd Coat: S-W Pro Industrial DTM Acrylic Eg-Shel Coating, B66W1250 Serie (2.5 - 4.0-mil dry per coat)

D. Metal – (Structural Steel Columns, Joists, Trusses, Beams, Miscellaneous & Ornamental Iron, Structural Iron, Ferrous Metal)
   1. Latex Systems
      a. Gloss Finish
         1) 1st Coat: S-W Pro Industrial Pro-Cryl® Universal Primer, B66W1300 Series (2.0 – 4.0-mil dry) – MPI #107
         2) 2nd Coat: S-W Pro Industrial Acrylic Gloss Coating, B66-600 Series – MPI #114
         3) 3rd Coat: S-W Pro Industrial Acrylic Gloss Coating, B66-600 Series (2.5 - 4.0-mil dry per coat)
      b. Semi-Gloss Finish
         1) 1st Coat: S-W Pro Industrial Pro-Cryl® Universal Primer, B66W1300 Series (2.0 – 4.0-mil dry) – MPI #107
         2) 2nd Coat: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series – MPI #153
         3) 3rd Coat: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series (2.5 - 4.0 mils (0.1016 mm) dry per coat)
      c. Eg-Shel/Satin Finish
         1) 1st Coat: S-W Pro Industrial Pro-Cryl® Universal Primer, B66W1300 Series (2.0 – 4.0-mil dry) – MPI#107
         2) 2nd Coat: S-W Pro Industrial DTM Acrylic Eg-Shel Coating, B66W1250 Series – MPI #151X-Green
         3) 3rd Coat: S-W Pro Industrial DTM Acrylic Eg-Shel Coating, B66W1250 Serie (2.5 - 4.0-mil dry per coat)

E. Drywall (Walls, Ceiling, etc.)
   1. Latex Systems
      a. Semi-Gloss Finish
         1) 1st Coat: S-W Premium Wall & Wood Primer, B28W8111 (4-mil wet, 1.8-mil dry) – MPI #N/A
         2) 2nd Coat: S-W Harmony Low Odor Interior Latex Semi-Gloss, B10 Series – MPI #147
         3) 3rd Coat: S-W Harmony Low Odor Interior Latex Semi-Gloss, B10 Series (1.6-mil dry per coat)
      b. Eg-Shel/Satin Finish
         1) 1st Coat: S-W Premium Wall & Wood Primer, B28W8111 (4-mil wet, 1.8-mil dry) – MPI #N/A
         2) 2nd Coat: S-W Harmony Low Odor Interior Latex Eg-Shel, B9 Series – MPI #144 X-Green
         3) 3rd Coat: S-W Harmony Low Odor Interior Latex Eg-Shel, B9 Series (1.6-mil dry per coat)
      c. Flat Finish Ceiling Only
         1) 1st Coat: S-W Premium Wall & Wood Primer, B28W8111 (1.8-mil dry) – MPI #N/A
         2) 2nd Coat: S-W Harmony Low Odor Interior Latex Flat, B5 Series – MPI #53X-Green
         3) 3rd Coat: S-W Harmony Low Odor Interior Latex Flat, B5 Series (1.6-mil dry per coat)
   2. Epoxy System (Water Base)
      a. Gloss Finish
         1) 1st Coat: S-W Premium Wall & Wood Primer, B28W8111 (1.8-mil dry) – MPI #N/A
         2) 2nd Coat: S-W Pro Industrial Water Based Catalyzed Epoxy, B73-300/ B73V300 – MPI #115

3) 3rd Coat: S-W Pro Industrial Water Based Catalyzed Epoxy, B73-300/ B73V300 B60V15 (2.0 – 4.0-mil dry per coat)

b. Eg-Shel Finish
1) 1st Coat: S-W Premium Wall & Wood Primer, B28W8111 (1.8-mil dry) – MPI #N/A
2) 2nd Coat: S-W Pro Industrial Water Based Catalyzed Epoxy Eg-Shel, B73-360 / B73V300 – MPI #254X-Green
3) 3rd Coat: S-W Pro Industrial Water Based Catalyzed Epoxy Eg-Shel, B73-360 / B73V300 (2.0- 4.0-mil dry per coat)

F. Drywall – Chrome Key (CCTV Filming Room)
1. Matte Finish
1) 1st Coat: S-W Harmony Low Odor Interior Latex Primer, B11W900 (4-mil wet, 1.3-mil dry)
2) 2nd Coat: Rosco Laboratories, Chroma Key Video Paint,150-05711, green color as selected by the Architect.
3) 3rd Coat: Rosco Laboratories, Chroma Key Video Paint, 150-05711, green color as selected by the Architect. (4-mil wet, 2-mil dry per coat)
2. Location: Main filming wall and both side walls to a point 10' from the main filming wall. No base is to be installed on the wall areas with Chroma Key Paint.

2.5 MATERIALS – GENERAL REQUIREMENTS

A. Paints and Coatings – General
1. Unless otherwise indicated, provide factory-mixed coatings.
2. When required, mix coatings to correct consistency in accordance with manufacturer's instructions before application.
3. Do not reduce, thin, or dilute coatings or add materials to coatings unless approved in manufacturer's product instructions.
4. Confirm VOC’s need by using the products MSDS sheets.

B. Primers: Where the manufacturer offers options on primers for a particular substrate, use primer categorized as “best” by the manufacturer.

2.6 ACCESSORIES

A. Coating application accessories: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required, per manufacturer’s specifications.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows (Do not apply finishes unless moisture content of surfaces is below the following maximums):
1. Concrete: 12 percent.
2. Fiber-Cement Board: 12 percent.
3. Masonry (Clay and CMUs): 12 percent.
4. Gypsum Board: 12 percent.
5. Plaster: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected.
1. Application of coating indicates acceptance of surfaces and conditions.

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E. Do not begin application of coatings until substrates have been properly prepared; notify Owner's Representative of unsatisfactory conditions before proceeding.

F. If substrate preparation is the responsibility of another installer, notify Owner's Representative of unsatisfactory preparation before proceeding.

G. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint film.

H. Test shop applied primer for compatibility with subsequent cover materials.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. The surface shall be dry and in sound condition. Remove all oil, dust, dirt, loose rust, peeling paint, or other contamination to ensure good adhesion.

E. Provide barrier coats over incompatible primers or remove and re-prime. Notify Architect in writing about anticipated problems using the specified finish coat material with substrates primed by others.

F. Impervious Surfaces:
   1. Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach.
   2. Rinse with clean water and allow surface to dry.
   3. Aluminum Surfaces:
      a. Remove all oil, grease, dirt, oxide, and other foreign material by cleaning per SSPC-SP 1 Solvent Cleaning.
   4. Block/Unit Masonry (Cinder and Concrete)"
      a. Remove all loose mortar and foreign material.
   5. Surface must be free of laitance, concrete dust, dirt, form release agents, moisture curing membranes, loose cement, and hardeners.
   6. Let concrete and mortar cure at least 30 days at 75°F unless the manufactures products are designed for application prior to the 30-day period.
   7. The pH of the surface and moisture content must be in accordance with the paint manufacturer's recommendations prior to painting.
   8. Concrete:
      a. Remove contamination by washing with an appropriate cleaner, rinse thoroughly.
   9. The pH of the surface and moisture content shall be in accordance with the paint manufacturer's recommendations prior to painting.
   10. Allow the surface to thoroughly dry.
   11. Clean concrete floor surfaces scheduled to be painted with a commercial solution of muriatic acid or other etching cleaner. Flush floor with clean water to neutralize acid and allow to dry before painting.
   12. Fill bug holes, air pockets, and other voids under another section with a cement-patching compound of sufficient cohesive strength to support the specified coating system.
   13. Drywall:

a. Shall be clean, dry and all dust removed prior to painting.
b. All nail heads must be set and spackled.
c. Tape all joints and cover with a joint compound.
d. Spackled nail heads and tape joints shall be sanded smooth.

14. Galvanized Surfaces:
    a. Clean per SSPC-SP 1 using detergent and water or a degreasing cleaner to remove greases and oils.
    b. Apply a test area, priming as required.
    c. Allow the coating to cure in accordance with the manufacturer's recommendation before testing.
    d. Perform adhesion tests in accordance with ASTM 3359 Adhesion by Tape Test.
    e. If adhesion is poor, then notify Owner's representative that additional surface preparation under another section is necessary to remove pre-treatments or contaminants that interfere with adhesion of the coating.
15. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.
16. Plaster Surfaces:
    a. Allow to thoroughly dry for at least 30 days before painting unless the manufacturer's products are designed for application prior to the 30-day period.
    b. Bare plaster must be cured and hard prior to painting.
    c. Correct any soft, porous, or powdery plaster per requirements under another section of the specifications.
17. Steel:
    a. Check other sections for additional surface preparation and shop priming of bare steel surfaces.
    b. Surface preparation shall include appropriate SSPC recommended methods.
    c. Shop primer shall be compatible with the field-applied coatings.
    d. Surfaces shall be dry and clean prior to the application of field-applied coatings.
    e. Remove all contaminants in accordance with SSPC-SP 1 Solvent Cleaning or SSPC Method recommended for condition of substrate.

3.3 MATERIALS PREPARATION

A. Mix and prepare painting materials in accordance with manufacturer's directions.

B. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing, and application of paint in a clean condition, free of foreign materials and residue.

C. Stir materials before application to produce a mixture of uniform density and stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.

D. Use only thinners approved by the paint manufacturer and only within recommended limits.

E. Tinting: Tint each undercoat of lighter shade to facilitate identification of each coat where multiple coats of the same materials are applied. Tint undercoats to match the color of the finish coat but provide sufficient differences in shade of undercoats to distinguish each separate coat.

F. Surface preparation, priming, and finish coats specified in this section are in addition to shop priming surface treatment specified under other sections.

G. Preparation and testing of existing painted surfaces, indicated to be repainted to accommodate new work, shall be performed as work of this section.

3.4 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

B. Use applicators and techniques suited for paint and substrate indicated.

C. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.

D. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

E. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

F. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

G. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

H. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

I. Apply paint in a cross-hatch application to achieve an even coverage.

3.5 FIELD QUALITY CONTROL

A. The right is reserved by Owner/Architect to invoke the following material testing procedure in addition to other tests indicated when and as often as he deems necessary during the period of field painting.

B. Engage services of an independent testing laboratory to sample paint being used. Samples of materials delivered to project site will be taken, identified and sealed, and certified in presence of Contractor.

C. Testing laboratory will perform appropriate tests for one or each of the following characteristics: Abrasion resistance, apparent reflectivity, flexibility, washability, absorption, accelerated weathering, dry opacity, accelerated yellowness, recoating, skinning, color retention, alkali resistance, and quantitative materials analysis.

D. A test patch for applied paint adhesion may be required.
   1. Adhesion text shall provide the adhesion X-cut and tape test for adhesion per ASTM D3359 for areas selected by the Architect.
   2. Areas found to be defective shall be have paint removed and repainting shall be provided.
   3. Owner/Architect may require retesting.

E. A test patch for remedial painting adhesion may also be required. The procedure for the test patch is as follows:
   1. An area that represents the worst condition of the existing paint is selected.
   2. The surface is prepared as appropriate for the repaint work.
   3. The new coating or coating system is applied.
   4. The coating is allowed to cure for at least 7 days at 75 degrees Fahrenheit (23.89 degrees Celsius). or according to the coating manufacturer's instructions.
   5. After proper curing the adhesion is tested using an acceptable method such as the Adhesion by Tape Test (ASTM D 3359).

F. If test results show that material being used does not comply with specified requirements, Contractor may be directed to stop painting work, and remove noncomplying paint; pay for testing; repaint surfaces coated with rejected paint; remove rejected paint from previously painted surfaces if, upon repainting with specified paint, the 2 coatings are noncompatible.

3.6 EQUIPMENT

A. Refer to Divisions 21, 22, 23, 26, 27, & 28 for schedule of color-coding and identification banding of equipment, ductwork, piping, and conduit.

B. Color code equipment, piping, conduit, and exposed ductwork in accordance with requirements indicated.
   1. Color band and identify with flow arrows, names, and numbering.

C. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

D. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
   1. Paint the following work where exposed in equipment rooms:
      a. Equipment, including both sides of panelboards.
      b. Uninsulated metal and plastic piping.
      c. Pipe hangers and supports.
      d. Metal and plastic conduit.
      e. Tanks that do not have factory-applied final finishes.
   2. Paint the following work where exposed in occupied spaces:
      a. Equipment, including both side of panelboards.
      b. Uninsulated metal and plastic piping.
      c. Pipe hangers and supports.
      d. Metal and plastic conduit.
      e. Duct, insulation having cotton or canvas insulation covering or other paintable jacket material.
      f. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
      g. Interior surfaces of air ducts that are visible through grilles and louvers with one coat of flat black paint.
      h. Paint dampers exposed behind louvers and grilles to match face panels.
      i. Other items as directed by Architect.

3.7 CLEAN-UP AND PROTECTION

A. Upon completion of painting work, clean window glass and other paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

B. Provide "Wet Paint" signs as required to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.

C. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

D. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

E. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

F. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.8 TOUCH-UP AND DAMAGE REPAIR

A. Contractor shall repair all deficiencies in coating application in accordance with PDCA Standard P1-04.

B. Inform Owner’s representative of all damage to properly painted surfaces and receive authorization prior to performing damage repair.

END OF SECTION

SECTION 10 11 00 - VISUAL DISPLAY UNITS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Markerboards (MMB).
   2. Tackboards (TB-1).
   3. Bulletin Boards (BB-1).

1.3 REFERENCE STANDARDS

A. AAMA 611 - Specification for Anodized Architectural Aluminum; 2026.

B. ANSI A135.4 - Basic Hardboard; 2012 (Reaffirmed 2020).

C. ANSI A208.1 - American National Standard for Particleboard; 2022.

D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

E. ASTM C208 - Standard Specification for Cellulosic Fiber Insulating Board; 2022.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements, for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 DEFINITIONS

A. Refer to Section 01 42 16 – Definitions, for the following terms:
   1. Visual Display Board Assembly.
   2. Visual Display Surface.

1.6 SUBMITTALS

A. Refer to Section 01 30 00.0 - Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 - Product Requirements for substitution procedures.

C. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for visual display surfaces.

D. Shop Drawings: For visual display surfaces. Include plans, elevations, sections, details, and attachments to other work.
   1. Show locations of panel joints.
   2. Include sections of typical trim members.

E. Samples for Initial Selection: For each type of visual display surface indicated, for units with factory-applied color finishes, and as follows:
   1. Actual sections of porcelain-enamel face sheet assembly.
   2. Fabric swatches of fabric-faced tack assemblies.
   3. Include accessory Samples to verify color selected.

F. Maintenance Data: For visual display surfaces to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of visual display units.

B. Source Limitations: Obtain visual display surfaces from single source from single manufacturer.

C. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: 25.
   2. Smoke-Developed Index: 450 or less.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-built visual display surfaces, including factory-applied trim where indicated, completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured panel size, provide two or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site.

B. Store visual display surfaces vertically with packing materials between each unit.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install visual display surfaces until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Field Measurements: Verify actual dimensions of construction contiguous with visual display surfaces by field measurements before fabrication.
   1. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

1.10 WARRANTY

A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer's standard form in which manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.

B. Markerboards:
   1. Failures include, but are not limited to, the following:
   2. Surfaces lose original writing and erasing qualities.
      a. Surfaces exhibit crazing, cracking, or flaking.
      b. Warranty Period: Life of the building.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
   1. Markerboards & Tackboards: Claridge Products and Equipment, Inc.
   2. Bulletin Boards: Forbo.

B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
   1. Quartet as subsidiary of ACCO Brams Corporation.

2. PolyVision Corporation; a Steelcase company.
3. American Visual Display Products, LLC

2.2 MARKERBOARDS (MMB)

A. Basis of Design Product: “Series 4 – LCS3” as manufactured by Claridge.

B. Porcelain-Enamel Markerboards: Balanced, high-pressure, factory-laminated markerboard assembly of three-ply construction consisting of backing sheet, core material, and 24-gauge, porcelain-enamel face sheet with off white low-gloss finish.

C. Porcelain-Enamel Face: Three coat process consisting of primer, ground coat and color cover coat.

D. Particleboard Core: 7/16" thick; with 0.015-inch- thick, aluminum sheet backing.

E. Laminating Adhesive: Manufacturer's standard, moisture-resistant thermoplastic type.

F. Size: As indicated on drawings.

G. Accessories:
1. Aluminum Frames and Trim: Fabricated from not less than 0.62-inch- (1.57-mm-) thick, extruded 1" wide aluminum; manufacturers standard size and shape.
   a. Factory-Applied Trim: Manufacturer's standard, with mitered corners.
2. Chalktray: Manufacturer's standard, continuous.
   a. Solid Type: Extruded aluminum with ribbed section and smoothly curved exposed ends.
3. Map Rail: Provide the following accessories:
   a. Display Rail: Continuous and integral with map rail; fabricated from cork approximately 1 to 2 inches (25 to 50 mm) wide.
   b. End Stops: Located at each end of map rail.
   c. Map Hooks: Two map hooks for every 48 inches (1219.2 mm) of map rail or fraction thereof.
   d. Map Hooks and Clips: Two map hooks with flexible metal clips for every 48 inches (1219.2 mm) of map rail or fraction thereof.
   e. Flag Holder: One for each room.
   f. Paper Holder: Extruded aluminum; designed to hold paper by clamping action.
4. Markerboard Splices: Adjoining markerboards shall be joined by steel concealed spline to assure alignment and hairline joints.

2.3 TACKBOARDS (TB-1)

A. Materials:
1. Cork: 1/4" thick cork, seamless single layer compressed fine grain bulletin board quality face sanded for natural finish laminates to substrate.
2. Substrate: 1/4" thick minimum Industrial Grade fiberboard core material with 0.015" thick aluminum sheet backing.
3. Vinyl Fabric Facing; Mildew resistant, washable 2-ply 100 percent recycled polyester fabric with a plain weave pattern. Comply with FS CCC-W-408 Type II, laminated to core.
   a. Trim: Manufacturer’s standard aluminum trim, with mitered corners.
   b. Size: 48" x 48" or as indicated on Drawings

2.4 BULLETIN BOARDS (BB-1)

A. Basis of Design Product: Refer to "Finish Color Summary Chart" on Drawings for product selection.

2.5 MATERIALS

A. Hardboard: ANSI A135.4, tempered.

B. Particleboard: ANSI A208.1, Grade M-1

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C. Fiberboard: ASTM C208.

D. Extruded Aluminum: ASTM B221 (ASTM B 221M), Alloy 6063.

2.6 FABRICATION

A. Markerboard Assemblies: Laminate porcelain-enamel face sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.

B. Tackboard Assemblies: Coordinate factory-assembled units with trim and accessories indicated. Join parts with a neat, precision fit.

C. Aluminum Frames and Trim: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to a neat, hairline closure.

D. Make joints only where the total length exceeds the maximum manufactured length, fabricate with the minimum number of joints, balanced around the center of the board, as acceptable to the Architect and Owner.

E. Provide the manufacturer's standard vertical joint system between abutting sections of marker board.

F. Provide the manufacturer's standard mullion trim at joints between marker boards and tack boards.

2.7 WALL ATTACHMENT

A. Markerboard Fasteners as follows:
   1. CMU: Butterfly bolts into block core.
   2. Drywall: Metal screws into metal stud system.
   3. CMU and Drywall: Adhesive as recommended by manufacturer.

B. Tackable Wall Surface:
   1. CMU and Drywall: Adhesive as recommended by manufacturer.

C. Space all markerboards 1/2" away from wall surface at walls adjacent to the exterior and provide aluminum closure strip full length at sides to close of space.

2.8 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.9 ALUMINUM FINISHES

A. Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: non-specular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0 inch (0.01 mm) or thicker) complying with AAMA 611.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.

B. Examine walls and partitions for proper preparation and backing for visual display surfaces.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances that could impair the performance of and affect the smooth, finished surfaces of visual display boards, including dirt, mold, and mildew.

C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display surfaces and wall surfaces.
   1. Prime wall surfaces indicated to receive and as recommended in writing by primer/sealer manufacturer and wall covering manufacturer.

3.3 INSTALLATION, GENERAL

A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.
   1. Markerboard mounting height 36" above finished floor to rail or as indicated on the drawings.
   2. Tackboard mounting height 36" above finished floor to rail or as indicated on the drawings.

B. Mounting: Assemblies shall be mounted with concealed fasteners; mastic adhesive will not be permitted.

3.4 INSTALLATION OF FACTORY-FABRICATED VISUAL DISPLAY BOARDS AND ASSEMBLIES

A. Visual Display Boards: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display boards with fasteners at not more than 16 inches (406.4 mm) o.c. Secure both top and bottom of boards to walls.

3.5 CLEANING AND PROTECTION

A. Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

C. Cover and protect visual display surfaces after installation and cleaning.

END OF SECTION

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SECTION 10 14 00 - SIGNAGE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, materials, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Tactile/raised letter plastic signs
   2. Individual plastic characters signs
   3. Signs of silk-screened characters on plastic
   4. Required sign type:
      a. Interior room, space, and area ID signs
      b. International symbols of accessibility for accessible spaces and exits
      c. Accessible routes
      d. Tactile “exit” signs
      e. Hazard and safety signs
      f. Evacuation plans

1.3 REFERENCE STANDARDS

A. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. ANSI A117.1 – Specifications for Making Buildings and Facilities Accessible To and Usable By Physically Handicapped People

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements, for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 - Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 - Product Requirements for substitution procedures.

C. Submit shop drawings as specified.

D. Indicate sign styles, lettering font, foreground and background colors, locations, overall dimensions of each sign and anchorage.

E. Provide complete interior and exterior sign schedule showing sign type, location, and verbiage.

F. Samples: Submit two sample signs in size illustrating type, style, letter font, and colors specified, and method of attachment.

G. Provide manufacturer’s installation instructions, templates, and attached devices.

H. Colors shall be as selected by the Architect.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.7 REGULATORY REQUIREMENTS

A. Conform to applicable codes for requirements for the physically handicapped, safety and egress.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to site.

B. Package signs, labeled in name groups

C. Store adhesive attachment tape at ambient room temperatures

1.9 FIELD CONDITIONS

A. Do not install signs when ambient temperature is lower than recommended by manufacturer.

B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
   1. ASI Sign Systems, Indianapolis, Indiana; Cincinnati, Ohio; Cleveland, Ohio.

B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
   1. Andco Industries Corp., Greensboro, North Carolina
   2. Baron Signs, Lake Park, Florida
   3. Multi-Graphics, Inc. Pelham, Georgia

2.2 FLORIDA AMERICANS WITH DISABILITIES ACT REQUIREMENTS

A. Manufacturer shall conform to tactile, Braille, letter size, and other requirements as required by Florida Accessibility Code for Building Construction and ANSI A117.1.

B. ADA requirements supersede technical specifications in this Section.

2.3 BUILDING SIGNAGE – GENERAL

A. General; applies to all signs except as noted:
   1. Material shall be minimum 1/8" clear matte acrylic stock with 3/8" radius corners.
      a. Exterior signs – Shall be UV stable material of non-petroleum base phenolic resin using sand carving process to create the raised lettering, which is an integral part of the sign.
      b. Interior signs – Shall be material of non-petroleum base phenolic resin using sand carving process to create the raised lettering, which is an integral part of the sign.
      c. Interior signs exposed to direct sun, shall be of same material as exterior signs.
      d. Paint shall be Matthews Acrylic Polyurethane system or equal.
         1) Shall be low VOC
         2) Shall be UV Stable
         3) Shall be lead and chromate free
         4) Minimum life expectancy of 10-years
   2. Applied lettering not allowed.
   3. Letters and background colors selected by Architect from manufacturer's standard colors.
   4. Mounting:
      a. Shall be with adhesives and non-removable oval head screws.
      b. Mount at locations as directed by Architect.
      c. Mount at 60" above finished floor to the center of the sign.
   5. Graphic Process with Braille in one of the following, but no applied lettering method allowed:
      a. Provide raised (photopolymer process)

b. Engraved letters
c. Sand craved process

6. Letters:
   a. Letters and numbers shall have width to height ratio between 3:5 and 1:1 and stroke width to height ratio between 1:5 and 1:10.
   b. Letters and numbers to be raised 1/32" upper case sans serif font with Grade 2 Braille.
   c. Raised characters shall be 5/8" high minimum and 2" high maximum.
   d. Pictograms shall have the equivalent verbal description directly below the pictogram.
7. Characters and backgrounds must be matte or other non-glaze surface and of castrating colors.

B. Room Name and Number Signs
   1. Provide a sign for each room or space to include name and room number.
      a. Minimum size of 3" high by 6" wide for signs, longer where nomenclature demands
   2. Mount number as directed by Architect.
   3. All spaces listed in Finish Schedule plus if more than one door is to a space, additional signs will be required one by number of doors to space.

C. Storage Signs
   1. Provide and install at mechanical and electrical rooms a sign mounted on the door to read as follows: "STORAGE NOT ALLOWED".
   2. Signs shall be matte acrylic plastic, red background with white letters 1 " high by width needed for copy and Braille, with 3/8" radius corners.
   3. Mount on doors with non-removable oval head screws verify number signs required.

D. Toilet Room Handicapped Signs
   1. Furnish and install one sign depicting National Handicapped Symbol (wheelchair) at each toilet room, equipped with facilities for the handicapped.
      a. Size shall be 6" by 10.5".

E. Fire Extinguisher, No Exit and Pull Station Sign
   1. Copy to read: “No Exit”, "Fire Pull Station Inside", and "Fire Extinguisher Inside".
   2. Red letters, same material, size and mounting as in A. General.
   3. NO EXIT sign shall have letter size as per NFPA 101 section 7.10.8.3.
   4. Braille sign not required for fire extinguisher.
   5. See plans for locations.

F. Stair Signs
   1. Provide tactile signs at each doorway leading to exit stairway.
   2. Wording on sign: "EXIT"

G. Fire Rated/Smoke Partition Labeling
   1. Field label all fire rated walls above ceiling level, with fire rating shown on the construction plans.
      a. Provide minimum 4” high block lettering stenciled on wall above finished ceiling, if in a storage, mechanical, electrical, or similar unfinished room, install at approximately 84 inches (2133.6 mm) above floor.
      b. (Contractor to use rating from permit plans) HOUR FIRE RATED WALL, PROTECT ALL OPENING AND THROUGH WALL PENETRATION PER CODE REQUIREMENTS.
   2. Field label all smoke partitions above ceiling level.
      a. Provide minimum 4" high block lettering stenciled on wall above finished ceiling, if storage, mechanical, electrical, or unfinished room, install at 84" above floor.
      b. SMOKE PARTITION, PROTECT ALL OPENING AND THROUGH WALL PENETRATION PER CODE REQUIREMENTS.

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H. Mechanical, Electrical, Data, and Similar Rooms
   1. Provide a sign saying "NO STORAGE" meeting the General requirements.
   2. If these rooms have pair of doors, provide sign saying "THIS DOOR TO REMAIN CLOSED AND LATCHED TOP AND BOTTOM, EXCEPT DURING THE TRANSFER OF EQUIPMENT".
      a. Sign shall have 1" high block letters and be permanently attached (Attached in way as to maintain the rating of the door) to the inactive door near the latch side 60 inches (1524 mm) from finished floor to center of sign.
      b. Braille not required for this sign.

I. Evacuation Plan
   1. Provide frame for a graphic floor plan in each student occupied room.
      a. Size to be nominal 9" high by 12" width
      b. Provide a clear removable plastic cover over each sign.
      c. Sign cover will only be removable using a tool.
   2. Mounting:
      a. Non-removable oval head screws, using rawl plugs where mounted on masonry.
      b. Architect shall supply the plans to the Contractor.
   3. Frame Material: Matte acrylic plastic with all edges eased and tempered glass or clear plastic cover.

2.4 BUILDING SPECIALITY SIGNAGE

A. "No Smoking" - “Smoke Free Campus” Signs.
   1. Copy to read: “No Smoking” or “Smoke Free Campus” with universal graphic.
   2. Mounting: Non-removable oval head screws, using rawl plugs where mounted on masonry.
   3. Signs shall be non-corrosive, 1/8” three ply laminate, UV inhibitors, non-glare surface, green background with white letters 3” high by width needed for copy.
   4. Graphic Process: Raised letters, and graphic, Braille shall be formed as an integral part of the sign face or surface applied to the sign face.
   5. Colors: Letters and background colors as selected by Architect from manufacturer’s standard colors.
   6. Letters: Letters and numbers shall have width to height ratio between 3:5 and 1:1 and a stoke width to height ratio between 1:5 and 1:10. Letters and numbers shall be raised 1/32” upper case sans serif font type with Grade 2 Braille. Verify exact location with Architect. Schedule is provided for verbiage and quantity for pricing purposes. Locations and final graphics/verbiage to be determined by Architect.
   7. Raised characters shall be 2” high. Pictograms shall be accompanied by the equivalent verbal description placed directly below the pictogram.

B. School Name and Address Letters/Numbers – Provide letters meeting the following requirements:
   1. Type: “Helvetica Medium” Letter Style. Provide minimum sufficient letters for School's name and building name as indicated on the drawings, subject to District approval.
   2. Color: Aluminum with Dark Bronze anodized finish.
   3. Size and Number:
      a. Primary Text
         1) 18 inches (457.2 mm) high x length as required for proper optical letter spacing.
         2) 10 ½ inches average width
         3) 2-1/8” inches strike width
         4) 1/4 inches (6.35 mm) depth
      b. Secondary Text
         1) 12 inches (304.8 mm) high x length as required for proper optical letter spacing.
         2) 8½ inches average width

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3) 2-1/8” inches strike width
4) 1/8 inches (3.18 mm) depth

4. Anchors: Stainless steel drilled in place concealed anchors minimum 2 anchors per letter.
5. Material: Welded aluminum back-channel fabricated non-illuminate letters.
6. Manufacturer: Andco Industries Corporation or equivalent.
7. Caulk: Seal perimeter of each letter to wall or frame with thin neat bead of clear silicone sealant.
8. Install using manufacturers approved anchoring method to meet ASTM 7 wind load requirements.
9. School name and street address shall be visible from the main road fronting the campus.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install all signs in strict accordance with manufacturer's instructions and FADA requirements.

B. Room signs to be mounted 60" to center above finish floor on walls adjacent to the latch side of any door opening.

3.2 CLEANING

A. After installation, thoroughly clean all exposed surfaces and restore all damaged material to its original condition or replaced with new material.

3.3 WARRANTY

A. Provide full guarantee of all materials and labor under this section for a period of 5-years from date of final acceptance of the building against all defects in both workmanship and materials and he shall promptly correct and/or replace such faulty work if so notified.

END OF SECTION

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SECTION 10 21 23 - CUBICLE CURTAINS AND TRACKS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Curtain track.
   2. Curtain carrier.
   3. Curtain fabric.
   4. Curtain accessories.

1.3 REFERENCE STANDARDS

A. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

D. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs; 2022.

E. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2023, with Errata.

F. AAMA 204 – Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.

G. AAMA 607.1 – Voluntary Guide Specification and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum.

H. ASTM B26 – Standard Specification for Aluminum-Alloy Sand Castings.

I. ASTM B85 – Standard Specification for Aluminum-Alloy Die Castings.

J. ASTM B177 – Standard Guide for Engineering Chromium Electroplating.

K. ASTM B209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

L. NFPA – National Fire Protection Association.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements, for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 - Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 - Product Requirements for substitution procedures.

C. Product Data: For each type of product.
   1. Include durability, laundry temperature limits, fade resistance, applied curtain treatment, and fire-test-response characteristics for each type of curtain fabric indicated.
   2. Include data for each type of track.

D. Shop Drawings:

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1. Show layout and types of cubicles, sizes of curtains, number of carriers, anchorage details, and conditions requiring accessories. Indicate dimensions taken from field measurements.
2. Include details on blocking above ceiling.

E. Samples: For each exposed product and for each color and texture specified, 10 inches (254 mm) in size.

F. Samples for Initial Selection: For each type of curtain material indicated.

G. Samples for Verification: For each type of product required, prepared on Samples of size indicated below:
1. Curtain Fabric: 10-inch square swatch or larger as required to show complete pattern repeat, from dye lot used for the Work, with specified treatments applied. Mark top and face of material.
2. Mesh Top: Not less than 10 inches (254 mm) square.
3. Curtain Track: Not less than 10 inches (254 mm) long.
4. Curtain Carrier: Full-size unit.
5. IV Hanger: Full-size unit.
6. IV Track: Not less than 10 inches (254 mm) long.
7. IV Carrier: Full-size unit.

H. Operation and Maintenance Data: For curtains, track, and hardware to include in operation and maintenance manuals.

1.6 PERFORMANCE REQUIREMENTS

A. Curtains: Provide curtain fabrics with the following characteristics:
1. Launderable to a temperature of not less than 160 degrees Fahrenheit (71.11 degrees Celsius).
2. Flame resistant and identical to those that have passed NFPA 701 when tested by a testing and inspecting agency acceptable to authorities having jurisdiction.
a. Identify fabrics with appropriate markings of a qualified testing agency.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
1. Inpro Corporation; www.inprocorp.com

B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
1. ARC-COM.
2. Construction Specialties.

2.2 CURTAIN SUPPORT SYSTEM COMPONENTS

A. Track System Basis of Design Product: Basis of Design Product: Refer to "Finish Color Summary Chart" on Drawings for product selections.

B. Curtain Track Accessories: Fabricate splices, end caps, connectors, end stops, coupling and joining sleeves, wall flanges, brackets, ceiling clips, and other accessories from same material and with same finish as track.
1. Suspended-Track Support: Not less than 7/8-inch OD tube.
2. End Stop: Nonremovable or removable with carrier hook.
3. Switch Unit: Shuttle and coupling device for rerouting and securing cubicle curtain, with pull chain for switching track.

C. Tie Backs (PCH-1):
   1. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
      a. Highland Forge: https://highlandforge.com/drapery-tiebacks
         1) Basis of Design Product: Basis of Design Product: Refer to "Finish Color Summary Chart" on Drawings for product selections.

D. Exposed Fasteners: Stainless steel.

E. Concealed Fasteners: Stainless steel.

2.3 CURTAINS (PC-1)

A. Basis of Design Product: Refer to "Finish Color Summary Chart" on Drawings for product selections.
   1. Cubicle Curtain Fabric:
      a. 53% post consumer recycled polyester and 47% FR Polyester.
      b. No. 50 nylon fabric mesh at top 18" of cubicle curtain.
         1) Mesh Top: 1/2" x 1/2"
   2. Curtain Grommets: Two-piece, rolled-edge, rustproof, nickel-plated brass; spaced not more than 6 inches (152.4 mm) o.c.; machined into top hem.
   3. Pattern and Color: As indicated on Drawings.

2.4 CURTAIN FABRICATION

A. Fabricate curtains as follows:
   1. Width: Equal to track length from which curtain is hung plus 10 percent added fullness, but not less than 12 inches (304.8 mm) added fullness.
   2. Length: Equal to floor-to-ceiling height, minus depth of track and carrier at top, and minus clearance above the finished floor as follows:
      a. Cubicle Curtains: 12 inches (304.8 mm)
   3. Top Hem: Not less than 1 inch (25.4 mm) and not more than 1-1/2 inches (38 mm) wide, triple thickness, reinforced with integral web, and double lockstitched.
   4. Mesh Top: Top hem of mesh not less than 1 inch (25.4 mm) and not more than 1-1/2 inches (38 mm) wide, triple thickness, reinforced with integral web, and double lockstitched. Double lockstitch bottom of mesh directly to 1/2-inch triple thickness, top hem of curtain fabric.
   5. Bottom Hem: Not less than 1 inch (25.4 mm) and not more than 1-1/2 inches (38 mm) wide, double thickness and double lockstitched.
   6. Side Hems: Not less than 1/2 inch (12.7 mm) and not more than 1-1/4 inches (32 mm) wide, with double turned edges, and single lockstitched.

B. Vertical Seams: Not less than 1/2 inch (12.7 mm) wide, double turned, and double stitched.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install tracks level and plumb, according to manufacturer's written instructions.

B. Up to 20 feet (609.6 cm) in length, provide track fabricated from single, continuous length.
   1. Curtain Track Mounting: Surface or as indicated on drawings.

C. Surface-Track Mounting: Fasten tracks to ceilings at intervals recommended by manufacturer. Fasten tracks at each splice and tangent point of each corner. Center fasteners in track to ensure unencumbered carrier operation. Attach track to ceiling as follows:
   1. Attach track to suspended ceiling grid with manufacturer's proprietary clip.
   2. Provide manufacturers standard spacers where track is installed at tegular suspended ceiling grid.

D. Track Accessories: Install splices, end caps, connectors, end stops, coupling and joining sleeves, and other accessories as required for a secure and operational installation.

E. Curtain Carriers: Provide curtain carriers adequate for 6-inch spacing along full length of curtain plus an additional carrier.

F. Curtains: Hang curtains on each curtain track.

END OF SECTION

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SECTION 10 26 00 - WALL AND DOOR PROTECTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specification and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Corner guards (CG-1).

1.3 REFERENCE STANDARDS

A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2023, with Editorial Revision.

B. ASTM D543 - Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents; 2021.

C. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 - Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 – Product Requirements for substitution procedures.

C. Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.

D. Shop Drawings: Include plans, elevation, sections, and attachment details. Show design and spacing of supports for protective corridor handrails, required to withstand structural loads.

E. Samples: Submit two samples illustrating component design, configurations, joinery, color and finish.

F. Manufacturer's Instructions: Indicate special procedures, perimeter conditions requiring special attention.

G. Maintenance Data: Manufacturer's instructions for care and cleaning of each type of product. Include information about both recommended and potentially detrimental cleaning materials and methods.

H. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.6 PERFORMANCE REQUIREMENTS

A. Impact Strength: Unless otherwise noted, provide protection products and assemblies that have been successfully tested for compliance with applicable provisions of ASTM D256 and/or ASTM F476.

B. Chemical and Stain Resistance: Unless otherwise noted, provide protection products and assemblies with chemical and stain resistance complying with applicable provisions of ASTM D543.

C. Fungal Resistance: Unless otherwise noted, provide protection products and assemblies which pass ASTM G21 testing.

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1.7 ATTIC STOCK

A. Furnish the following for Owner's use in maintenance of project:
   1. Corner Guards (Field Color): 10 complete assemblies.
   2. Corner Guards (Accent Color): 4 complete assemblies.

B. Extra Stock Materials: One package(s) of minimum 96 inches (2438 mm) long unit of each kind of covers for corner guards, bumper rails, and protective corridor handrails.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.

B. Protect work from moisture damage.

C. Protect work from UV light damage.

D. Do not deliver products to project site until areas for storage and installation are fully enclosed, and interior temperature and humidity are in compliance with manufacturer's recommendations for each type of item.

E. Store products in either horizontal or vertical position, in compliance with manufacturer's instructions.

1.9 WARRANTY

A. Manufacturer Warranty: Provide 5-year manufacturer warranty for metal crash rails. Complete forms in Owner's name and register with manufacturer.
   1. Failures include, but are not limited to, the following:
      a. Structural failures or internal connection failures.
      b. Deterioration of materials beyond that expected of normal use, as intended by manufacturer.

B. Installer Warranty: Provide 5-year warranty for metal crash rails commencing on Date of Substantial Completion. Complete forms in Owner's name and register with installer.
   1. Failures include, but are not limited to, the following:
      a. Detachment of rail system from substrate.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
   1. Corner Guards: Inpro: www.inprocorp.com/#sle.

B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product.
   1. Construction Specialties, Inc: www.c-sgroup.com/#sle.
   2. Koroseal Interior Products: www.koroseal.com/#sle.

2.2 PRODUCT TYPES

A. Corner Guards:
   1. Basis of Design Product: Refer to "Finish Color Summary Chart" on Drawings for product selection.
   2. Material: As indicated on Drawings
   3. Color/Finish: As indicated on Drawings.
   4. Leg Size: As indicated on Drawings.
   5. Radius: 90 degree angle.

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6. Installation method: Surface mounted.

2.3 FABRICATION

A. Fabricate components with tight joints, corners and seams.

B. Pre-drill holes for attachment.

C. Form end trim closure by capping and finishing smooth.

2.4 SOURCE QUALITY CONTROL

A. Provide wall and door protection systems of each type from a single source and manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.

B. Verify that field measurements are as indicated on drawings.

C. Verify that substrate surfaces for adhered items are clean and smooth.

1. Test painted or wall covering surfaces for adhesion in inconspicuous area, as recommended by manufacturer. Follow adhesive manufacturer's recommendations for remedial measures at locations and/or application conditions where adhesion test's results are unsatisfactory.

D. Start of installation constitutes acceptance of project conditions.

3.2 INSTALLATION

A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.

B. Position corner guard as indicated on Drawings.

3.3 TOLERANCES

A. Maximum Variation from Required Height: 1/4 inch (6 mm).

B. Maximum Variation from Level or Plane For Visible Length: 1/4 inch (6 mm).

3.4 CLEANING

A. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

END OF SECTION

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SECTION 10 28 00 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, materials, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Toilet accessories.
   2. Underlavatory guards.

1.3 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2022.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

E. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.

F. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium; 2017 (Reapproved 2022).

G. ASTM C1036 - Standard Specification for Flat Glass; 2025.

H. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2025.

I. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2024.

J. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings; 2025.

K. ASTM F446 - Standard Consumer Safety Specification for Grab Bars and Accessories Installed in the Bathing Area; 2019 (Reapproved 2023).

L. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

M. ANSI A117.1 – Safety Standards for the Handicapped.

N. ADA Accessibility Guidelines for Buildings and Facilities July 23, 2004 – Provisions for Children.

O. ASTM A167 – Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.

P. ASTM A269 – Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

Q. ASTM A666 – Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

R. ASTM A794 – Standard Specifications for Commercial Steel, Carbon, Cold-Rolled.

S. OSHA Department of Labor CFR 29, section 1910.141: Sanitation.

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1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements, for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 - Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 - Product Requirements for substitution procedures.

C. Product Data: For each type of product.
   1. Include construction details, material descriptions gauges, dimensions of individual components and profiles, and finishes.
   2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
   3. Include electrical characteristics.

D. Samples: Submit two samples of each accessory illustrating color and finish.

E. Sample Warranty: For manufacturer's special warranty.

F. Include maintenance instructions and manufacturer’s list of replaceable parts and service recommendations.

G. Maintenance Data: For accessories to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Provide products from a firm that makes the indicated products as a regular production item and with not less than ten (10) years experience.

B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation of specified materials and assemblies with not less than five (5) years experience.

C. Inserts and Anchorages: Provide accessory Manufacturers' standard inserts and anchoring devices that must be set in concrete or built into masonry. Coordinate delivery with other Work to avoid delay.

D. Field Verification: Before start of installation of wall finishes, installer shall verify that required blocking has been installed in proper locations. Verify that installation of finishes and required anchoring devices are complete.

E. Industry Standards: Work shall comply with applicable provisions of the following:
   1. OSHA Department of Labor CFR 29, section 1910.141: Sanitation.
   2. Florida Building Code, Chapter 11 – Florida Accessibility Code for Building Construction
   3. ANSI A117.1 – Safety Standards for the Handicapped
   4. ADA Accessibility Guidelines for Buildings and Facilities July 23, 2004 – Provisions for Children

1.7 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.8 FIELD CONDITIONS

A. Coordinate accessory locations, installation, and sequencing with other Work to avoid interference with and ensure proper installation, operation, adjustment, cleaning, and servicing of toilet accessory items.

B. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

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C. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.9 WARRANTY

A. Toilet Accessory Warranty: Provide manufacturer's one (1) year warranty from the Date of Substantial Completion, against defects in material and workmanship, unless otherwise indicated.

B. Mirror Warranty: Submit a written warranty executed by mirror manufacturer, agreeing to replace any mirrors that develop visible silver spoilage defects within 15 years from the Date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
   1. Bobrick.
   2. Manufacturers listed in the schedule for a specific item.

B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
   1. Bradley Corporation.
   2. American Specialties, Inc.
   3. AJW Architectural Products.

2.2 UNDERLAVATORY GUARDS

A. Underlavatory Guard:
   1. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings. To be provided at all exposed piping. Provide Truebro Lav Guard 2 as manufacturer by IPS Corp.
   2. Material and Finish: Antimicrobial, molded plastic, white.

2.3 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.

B. Stainless Steel Tubing: ASTM A269/A269M, Type 304 or 316

C. Steel Sheet: ASTM A1008/A1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.

D. Galvanized-Steel Sheet: ASTM A653/A653M, with G60 (Z180) hot-dip zinc coating.

E. Galvanized-Steel Mounting Devices: ASTM A153/A153M, hot-dip galvanized after fabrication.

F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

G. Chrome Plating: ASTM B456, Service Condition Number SC 2 (moderate service).

H. Mirror Glass: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 0.24 inch (6 mm) thick.

I. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.

J. Mirror Glass: Tempered safety glass, ASTM C1048; and ASTM C1036 Type I, Class 1, Quality Q2, with silvering as required.

K. Galvanized Steel Mounting Devices: ASTM A153, hot-dip galvanized after fabrication.

L. Fasteners: Screws, bolts, and other devices of same material as accessory unit, or of galvanized steel where concealed.

2.4 FABRICATION

A. No names or labels are permitted on exposed faces of toilet and bath accessory units. On either interior surface not exposed to view or on back surface, provide identification of each accessory item either by a printed, waterproof label or a stamped nameplate indicating Manufacturer's name and product model number.

B. Surface-Mounted Toilet Accessories, General: Except where otherwise indicated, fabricate units with tight seams and joints, exposed edges rolled. Hang doors or access panels with continuous stainless steel piano hinge. Provide concealed anchorage wherever possible.

C. Recessed Toilet Accessories, General: Except where otherwise indicated, fabricate units of all-welded construction, without mitered corners. Hang doors or access panels with full-length, stainless steel piano hinge. Provide anchorage that is fully concealed when unit is closed.

D. Keys: Provide universal keys for access to toilet accessory units requiring internal access for servicing, resupply, etc. Provide minimum of six keys to Owner's representative.

2.5 KEYING

A. Supply four keys for each accessory to Owner.
   1. Provide a master-key system for all accessories.

2.6 FINISHES

A. Galvanizing ASTM A123 to 1.25-oz/sq yd Galvanize ferrous metal and fastening devices.

B. Shop Primed Ferrous Metals: Pre-treat and clean, spray apply one coat primer and bake.

C. Enamel: Pre-treat to clean condition, apply one-coat primer and minimum two-coat epoxy baked enamel.

D. Chrome/Nickel Plating: ASTM B456, Type SC 2 satin finish.

E. Stainless Steel: No. 4 satin luster finish.

F. Back paint components where in contact with building finishes helping resist electrolysis.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install toilet accessory units according to manufacturers' instructions, using fasteners appropriate to substrate as recommended by unit manufacturer. Install units plumb and level, firmly anchored in locations and at heights indicated.

B. Secure mirrors to walls in concealed, tamperproof manner with special hangers, toggle bolts, or screws. Set units plumb, level, and square at locations indicated, according to Manufacturer's instructions for type of substrate involved.

C. Install grab bars to withstand a downward load of at least 250 lbf, complying with ASTM F446.

D. Provide all items and accessories as required for a complete and total installation in every respect, whether or not specified or indicated on the drawings.

E. Soap Unit:
   1. Secured to wall above lavatory with two screws.
   2. Exact location shall be indicated by Architect at the time of installation.

3. Coordinate the location of this dispenser so that no conflict occurs at either the wall mounted mirror above the lavatory or the faucet assembly mounted on the deck of the lavatory.

F. Coordinate bottom opening towel dispenser with wall cabinets above so conflict occurs when dispenser is opened to load towels.

G. Provide one (1) mop holder at each custodial sink. Mount at 60" AFF.

3.2 ADJUSTING AND CLEANING

A. Adjust toilet accessories for proper operation and verify that mechanisms function smoothly. Replace damaged or defective items.

3.3 SCHEDULE

A. The following schedule is based on products manufactured by Bobrick except as otherwise indicated.

B. Refer to symbols on Drawings.

SYMBOL	CATALOG	DESCRIPTION
TA2	B-2908	Lavatory Mirror; 1/4" thick Tempered Glass Mirror with Stainless Steel Angle Frame,18" W. x 36" H.
TA9	B-6806 x 36	Grab Bar, 1-1/2” Diameter Horizontal Straight with Concealed Fasteners, 36” Long
TA5	B-6806 x 42	Grab Bar, 1-1/2” Diameter Horizontal Straight with Concealed Fasteners, 42” Long
TA10A	B-5181	Shower Seat, Folding Phenolic Reversable – Surface Mounted 33” W. x 20-15/16” H. x 22-5/16” D.
TA12	B-207x60B-204-3, B-204-1	Shower Rod 60” L with Hooks and 70” W. x 72” H. Shower Curtain
TA11	B-7672	Robe Hooks, Double, stainless steel, bright finish.
TA8	B-239 x 34	Mop Racks with Shelf and Hooks – Surface Mounted, 34" long x 13" H.
TA16C	KB200	Diaper Changing Station, Folding Surface Mounted –35-3/16" W. x 22-1/4" H. x 23-3/16" D.Color as selected by the Architect
TA4	TBD	Paper Towel Dispenser.

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TA14	B-3944	12 gallon, Recessed Paper Towel Dispenser/Waste Receptacle.
TA17R	TBD	Recessed trash receptacle.
TA17U	TBD	Undercounter trash receptacle.
TA19	TBD	Water closet cover dispenser.

END OF SECTION

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SECTION 10 43 16 - FIRST AID CABINET

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES:

A. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Wall mounted first aid cabinet.

1.3 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements, for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.4 SUBMITTALS

A. Refer to Section 01 30 00.0 - Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 - Product Requirements for substitution procedures.

C. Product Data: Provide UL listing/rating, insurance ratings, dimensions, and anchorage/installation instructions.

D. Provide the manufacturer's warranty information.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
   1. American First Aid Kits, Inc.

2.2 COMPONENTS

A. Cabinet Basis of Design Product: Model # 247-0
   1. Metal wall mount cabinet, 15 3/16” wide x 16 3/8” high x 5 13/16” deep.

B. Three (3) metal shelves

C. Manufacturers standard 941 piece first aid items.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing site conditions.

3.2 INSTALLATION

A. Install cabinet in accordance with manufacturer's instructions in the location shown on plans.

B. Provide all material, accessories, and labor to complete the installation.

END OF SECTION

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SECTION 10 43 18 - MEDICAL STORAGE CABINETS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, materials, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Medical storage cabinet.

1.3 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements, for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.4 SUBMITTALS

A. Refer to Section 01 30 00.0 - Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 - Product Requirements for substitution procedures.

C. Shop drawings: Indicate the model number, type of material, gauges, or thickness of metal finishes, and details of construction and attachment.

D. Product data: Submit manufacturer’s catalog data and installation instructions for each type of item specified. Unless otherwise indicated, submit the following for each type of product provided under work of this Section.

1.5 WARRANTY

A. Warranty: Manufacturer shall warrant the product against defects in materials or workmanship and agrees to repair or replace components that fail within specified warranty period. The warranty period shall commence at the time of substantial completion and extend for a period of three (3) years.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
   1. UMF (United Metal Fabricators) Medical

2.2 MATERIALS

A. Basis of Design Product: “7000 Series narcotic locker, model #7780”

B. Size: 18” wide x 24” high x 12” deep.

C. Cabinet:
   1. 20-gauge steel cabinet construction
   2. Three adjustable metal shelves
   3. Heavy duty piano door hinge

D. Doors:
   1. 20-gauge double wall outer door
   2. 14-gauge single wall inner door
   3. Cam-style lock on each door, with two keys each

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E. Finish: Baked on enamel.

F. Color: As selected by Architect from Manufacturer's full range of color options.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install shelving units in strict accordance with the manufacturer's printed instructions, drawings and specifications, and approved shop drawings.
   1. Provide additional supports or attachments required for installation.

B. Provide reinforcement of supports as required and coordinate work with other trades.

C. Locate units where shown on drawings.

3.2 CLEANING

A. Clean shelving and cabinets with a damp cloth, leaving them in clean condition, free from dirt, smears, fingerprints, and other foreign matter.

END OF SECTION

SECTION 10 44 00 - FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Fire protection cabinets for portable fire extinguishers (FEC).
   2. Portable fire extinguishers (FE).
   3. Fire extinguisher brackets.
   4. Fire protection cabinets for portable fire extinguishers with fire blanket.

1.3 REFERENCE STANDARDS

A. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.

B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

C. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2024.

D. NFPA 10 - Standard for Portable Fire Extinguishers; 2026.

E. NFPA 2001 - Standard on Clean Agent Fire Extinguishing Systems; 2025, with Amendment (2026).

F. SSPC-SP 5/NACE No.1 - White Metal Blast Cleaning; 2026.

G. ASTM B209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

H. Carbon Dioxide Types UL 154.

I. Dry Chemical Types UL 299.

J. Water Types UL 626.

K. Halon Types UL 1093.

L. UL 92 – Fire Extinguisher & Booster Hose.

M. UL 711 – Rating and Fire Testing of Fire Extinguishers.

N. NFPA 2001, Standard on Clean Agent Fire Extinguishing Systems.

O. Portable fire extinguishers used to comply with this standard shall be listed and labeled and meet or exceed all the requirements of Fire Test Standards UL 711.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements, for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 - Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 - Product Requirements for substitution procedures.

C. Product Data: For each type of product indicated door hardware, cabinet type, trim style, and panel style. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire protection cabinets.

1. Fire Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

D. Shop Drawings: For fire protection cabinets. Include plans, elevations, sections, details, and attachments to other work.

E. Samples: For each type of exposed finish required, prepared on samples of size 6 by 6 inches (152.4 mm) square.

F. Product Schedule: For fire protection cabinets. Coordinate final fire protection cabinet schedule with fire extinguisher schedule to ensure proper fit and function. Use same designations indicated on drawings.

1.6 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Provide products from a firm that makes the indicated products as a regular production item and with not less than ten (10) years experience.

B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation of specified materials and assemblies with not less than five (5) years experience.

C. Installer Qualifications: Shall be State of Florida certified.

D. Conform to NFPA 10 requirements for all portable fire extinguishers and fire blankets.

E. Provide fire extinguishers, cabinets, fire blankets, and accessories by single manufacturer.

F. The identification of the listing and labeling organization, the fire test, and the performance standard that the fire extinguisher meets or exceeds shall be clearly marked on each fire extinguisher.

1.7 PERFORMANCE REQUIREMENTS

A. Performance: Fire extinguishers shall be UL-rated, fully charged and ready for emergency use when applicable per the Florida Building Code, the Florida Fire Prevention Codes, NFPA 10 as adopted by the Florida State Fire Marshall Office and NFPA standards as adopted by the Florida State Fire Marshall Office.

B. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E814 for fire-resistance rating of walls where they are installed.

1.8 FIELD CONDITIONS

A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire protection cabinets with wall depths.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguisher cabinets that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Failure of hydrostatic test according to NFPA 10.
      b. Faulty operation of valves or release levers.
   2. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with

Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.

1. J. L. Industries, Inc., a division of Activar Construction Products Group.

B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
   1. Amerex Corporation
   2. Ansul Incorporated
   3. Larsen's Manufacturing Company
   4. Potter Roemer LLC

2.2 EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet and mounting bracket indicated.
   1. Valves: Manufacturer's standard.
   2. Handles and Levers: Manufacturer's standard.
   3. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.

B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 2-A:10-B:C, 5 lb. nominal capacity in enameled steel tank with pressure gauge size and classification as scheduled. To be used at all locations unless noted otherwise.

C. Purple-K Dry-Chemical Type in Aluminum Container: UL-rated 2.5-lb nominal capacity, with potassium bicarbonate-based dry chemical in enameled-aluminum container. To be used in food preparation areas.

D. Stored-Pressure Water-Mist Type: WM-Series UL-rated 2-A:C, 2.5-gal. nominal capacity, with water in enameled-steel container; with pressure-indicating gauge. To be used in computer labs.

E. Carbon Dioxide Type: UL 154, Stainless steel tank with pressure gauge size and classification as scheduled, or if not scheduled, provide 10-B:C, 5 lb. nominal capacity. To be used in electrical rooms.

F. Provide additional types to comply with conditions.

G. Extinguisher Finish:
   1. Multi-purpose units: Provide heavy-duty, DOT steel cylinders with corrosion and impact resistant polyester/epoxy paint finish.
   2. Gaseous and wet chemical units: Provide stainless steel, satin chrome finish.

2.3 SEMI-RECESSED FIRE PROTECTION CABINET

A. Basis of Design Product: “Academy Series, Model 1027”

B. Cabinet Metal: Use a formed sheet steel, galvanized 18-gauge thick base metal.

C. Configuration: Semi-recessed type, per drawing details and locations, sized to accommodate required extinguishers, combination fire extinguisher cabinet and accessories.

D. Cabinet Trim Style: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.
   1. Exposed Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
      a. Rolled Edge Trim: 2-1/2 inch (64 mm) backbend depth (semi-recessed) surface.

E. Cabinet Trim Material: Manufacturer’s standard, as follows:
   1. Extruded aluminum shapes.

F. Door Style: Manufacturer’s standard design, as follows:

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1. Vertical duo glazed panel with pull.

G. Door Construction: Fabricate doors according to manufacturer's standards, of materials indicated, and coordinated with cabinet types and trim styles selected.
   1. Provide minimum 1/2 inch (12.7 mm) thick door frames, fabricated with tubular stiles and rails, and hollow metal design.

H. Door: Extruded aluminum shapes, reinforced for flatness and rigidity.

I. Door Glazing: Clear transparent acrylic sheet.

J. Cabinet Mounting Hardware: Appropriate to cabinet and extinguisher size and weight.

K. Form cabinet enclosure with right angle inside corners and seams.
   1. Form perimeter-trim and door stiles.

L. Pre-drill the unit for anchors and accessories.

M. Hinge doors for 180° opening with continuous piano hinge.
   1. Provide nylon self-adjusting roller catch.
   2. Provide recessed door pull.

N. Glaze doors with resilient channel gasket glazing.

O. Identification: Provide lettering to comply with authorities having jurisdiction for letter style, color, size, spacing, and location.
   1. Identify fire extinguisher in cabinet with the words "FIRE EXTINGUISHER" applied to door.
      a. Location: Applied to cabinet door.
      b. Application Process: Pressure-sensitive vinyl letters.
      c. Lettering Color: Red.
      d. Orientation: Vertical.

P. Fire Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.0428 inch (1.09 mm) thick, cold-rolled steel sheet lined with minimum 5/8" thick fire-barrier material. Provide UL Certification.

2.4 SEMI-RECESSED FIRE PROTECTION CABINET WITH BLANKET

A. Basis of Design Product: "3600 Series"

B. Cabinet Metal: Use a formed sheet steel, galvanized 18-gauge thick base metal.

C. Configuration: Semi-recessed type, per drawing details and locations, sized to accommodate required extinguishers, combination fire extinguisher and fire blanket cabinet and accessories.

D. Cabinet Trim Style: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.
   1. Exposed Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
      a. Rolled Edge Trim: 2-1/2 inch (64 mm) backbend depth (semi-recessed) surface.

E. Cabinet Trim Material: Manufacturer's standard, as follows:
   1. Extruded aluminum shapes.

F. Door Style: Manufacturer's standard design, as follows:
   1. Vertical duo glazed panel with pull.

G. Door Construction: Fabricate doors according to manufacturer's standards, of materials indicated, and coordinated with cabinet types and trim styles selected.
   1. Provide minimum 5/8 inch (15.88 mm) thick door frames, fabricated with tubular stiles and rails, and hollow metal design.

H. Door: Extruded aluminum shapes, reinforced for flatness and rigidity.

I. Door Operation: Emergency open handle.

J. Door Glazing: Clear transparent acrylic sheet.

K. Blanket Shelf: Shelf located 9” from top of cabinet to support blanket.

L. Cabinet Mounting Hardware: Appropriate to cabinet and extinguisher size and weight.

M. Form cabinet enclosure with right angle inside corners and seams.
   1. Form perimeter-trim and door stiles.

N. Pre-drill the unit for anchors and accessories.

O. Hinge doors for 180° opening with continuous piano hinge.
   1. Provide nylon self-adjusting roller catch.
   2. Provide recessed door pull.

P. Glaze doors with resilient channel gasket glazing.

Q. Identification: Provide lettering to comply with authorities having jurisdiction for letter style, color, size, spacing, and location.
   1. Identify fire extinguisher in cabinet with the words “FIRE EXTINGUISHER” and FIRE BLANKET” applied to door.
      a. Location: Applied to cabinet door.
      b. Application Process: Pressure-sensitive vinyl letters.
      c. Lettering Color: Red.
      d. Orientation: Vertical.

R. Fire Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.0428 inch (1.09 mm) thick, cold-rolled steel sheet lined with minimum 5/8” thick fire-barrier material. Provide UL Certification.

2.5 MOUNTING BRACKETS

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
   1. J. L. Industries
      a. Bracket Basis of Design Product: "MARK"

B. Size: Provide wall and cabinet bracket required for types and capacities of fire extinguishers indicated, and to hold extinguishers firmly and securely in place, with easy removal of extinguishers for emergency purposes.

C. Bracket material: Manufacturer's standard galvanized steel.

D. Finish: Plated or baked-enamel finish.

E. Color: Red.

F. Identification: Provide 8” x 8” minimum plastic sign on the wall above the mounting bracket. Lettering shall comply with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
   1. Provide at hand held extinguishing units not in fire protection cabinets.
   2. Sign shall be fabricated with the words "FIRE EXTINGUISHER" in red letter letters applied to the white plastic sign surface.
      a. Orientation: Horizontal.

2.6 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B.

B. Extruded Aluminum: ASTM B221.

C. Acrylic Glazing: Clear acrylic

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2.7 ACCESSORIES

A. Fire Blanket: Fire retardant treated wool red color 62 x 84 inch (2133.6 mm) size, with wall mounted case.

2.8 FABRICATION

A. Fire Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
   1. Weld joints and grind smooth.
   2. Provide factory-drilled mounting holes.
   3. Prepare doors and frames to receive handle.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
   1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch (12.7 mm) thick.
   2. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

D. Brackets and cabinets shall be designed to prevent accidentally dislodging extinguisher and shall be size required for type and capacity of extinguisher indicated.

2.9 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

E. Steel Finishes
   1. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No.1, "White Metal Blast Cleaning" or SSPC-SP 8, "Pickling". After cleaning, apply a conversion coating suited to the organic coating to be applied over it.
   2. Factory Prime Finish: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
   3. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.0508 mm).
      a. Cabinet Tub Color: White
      b. Fire Extinguishers: Red

F. Aluminum Finishes
   1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
   2. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0 inch (0.01 mm) or thicker) complying with AAMA 607.1.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify all rough openings, dimensions and clearances are the correct size and in the correct location prior to installation.

B. Examine the areas and conditions of the work in this Section.
   1. Correct conditions detrimental to timely and proper completion of the Work.
   2. Do not proceed until unsatisfactory conditions are correct.

C. Verify servicing, charging, and tagging of all fire extinguishers.

D. Examine fire extinguishers for proper charging and tagging.
   1. Remove and replace damaged, defective, or undercharged fire extinguishers.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for fire protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights indicated below:
   1. Fire Protection Cabinets: 48 inches (1219.2 mm) above finished floor to top of cabinet.

B. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.
   1. Provide inside latch.
   2. Fasten mounting brackets to inside surface of fire protection cabinets, square and plumb.

C. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
   1. Mounting Brackets: 54 inches (1371.6 mm) above finished floor to top of fire extinguisher.

D. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

E. Recharge existing fire extinguisher for units that are indicated to remain, replace if recharging is not possible.

F. Provide occupancy hazard protection with fire extinguishers suitable for such Class A, B, C, D, or K fire potentials as might be present. Class K shall be provided in all food preparation areas.

G. Install fire extinguishers in accordance with NFPA 10.

H. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

I. Install cabinets plumb and level in wall openings in strict accordance with NFPA 10, the original design, the approved Shop Drawings and the manufacturer's recommended installation procedures as approved by the Architect and authorizing agencies, anchoring all components firmly into position for long life under hard use.
   1. Secure rigidly in place.

J. Do not install extinguishers until Substantial Completion inspection date.
   1. Place extinguishers and accessories in cabinets or on wall brackets.

K. Inspection tags shall be current as of the date of Substantial Completion and good for 1-year.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire protection cabinets are installed unless otherwise indicated in manufacturers written installation instructions.

B. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes or replace fire protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.

E. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

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SECTION 10 51 13 - METAL LOCKERS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Knocked-down staff lockers.

1.3 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

B. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.

C. ASTM D3451 - Standard Guide for Testing Coating Powders and Powder Coatings; 2024.

D. ASTM A879 – Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements, for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 - Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 - Product Requirements for substitution procedures.

C. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker.

D. Shop Drawings:
   1. Include plans, elevations, sections, details, and attachments to other work.
   2. Show locker trim and accessories.
   3. Include locker identification system and numbering sequence.

E. Samples: For each color specified, in manufacturer's standard size.

F. Qualification Data: For Installer.

G. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Provide products from a firm that makes the indicated products as a regular production item and with not less than ten (10) years experience.

B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation of specified materials and assemblies with not less than five (5) years experience.

C. Regulatory Requirements: Where metal lockers are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's

"Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG) and Florida Building Code 2001"

1. Provide not less than 1 shelf located no higher than 54 inches (1371.6 mm) above the floor for side reach.
2. Provide hardware that does not require tight grasping, pinching, or twisting of the wrist, and that operates with a force of not more than 5 lb.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions by field measurements before fabrication.

B. Coordinate sizes and locations of bases for metal lockers.

C. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.
   1. Failures include, but are not limited to structural failures, faulty operation of latches and other door hardware.
   2. Warranty Period for Knocked-Down Metal Lockers: One (1) year from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
   1. Lyons, LLC

B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
   1. Penco Products, Inc.
   2. Republic Storage Products, LLC

2.2 KNOCKED-DOWN LOCKERS

A. Size: 15” wide x 15” deep x 60” high, three (3) tier.

B. Louvered Doors: One piece; fabricated from 14-gauge steel sheet with six 3 1/2" louvers top and bottom.
   1. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches (381 mm) wide; welded to inner face of doors.

C. Body: Assembled by riveting or bolting body components together. Fabricate from unperforated steel sheet with thicknesses as follows:
   1. Tops and Bottoms: 16-gauge steel, with single bend at sides.
   2. Backs: 18-gauge steel.
   3. Shelves: 16-gauge steel, with double bend at front and single bend at sides and back, locate 9" below top of locker.

D. Sides: Fabricated from 16-gauge steel sheet.

E. Frames: Channel formed; fabricated from 16-gauge steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral, full-height door strikes on vertical main frames.

F. Hinges: Welded to door and attached to door frame with no fewer than two factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.
   1. Knuckle Hinges: Steel, full loop, 0.050 thick steel, double spun, 5-knuckle with spun over pin endstight; minimum 2 inches (50.8 mm) high. Provide no fewer than three hinges for each door more than 42 inches high.

G. Recessed Door Handle and Latch: Stainless-steel cup with integral door pull, recessed so locking device does not protrude beyond door face; pry and vandal resistant.
   1. Multipoint Latching: Finger-lift latch control designed for use with padlocks; positive automatic latching and pre-locking.

H. Locks: Combination padlocks.

I. Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum plates, with numbers and letters at least 3/8 inch (9.52 mm) high.

J. Hooks: Manufacturer's standard ball-pointed type hooks, aluminum or steel; zinc plated.

K. Continuous Sloping Tops: Fabricated from 18-gauge nominal-thickness steel sheet, with a pitch of approximately 20 degrees.
   1. Closures: Vertical end type.

L. Recess Trim: Fabricated from 18-gauge steel sheet.

M. Filler Panels: Fabricated from 18-gauge steel sheet.

N. Boxed End Panels: Fabricated from 16-gauge steel sheet.

O. Base: Metal.

2.3 ACCESSORIES

A. Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.

B. Anchors: Material, type, and size required for secure anchorage to each substrate.
   1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls for corrosion resistance.
   2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

C. Equipment: Provide each locker with an identification plate and the following equipment:
   1. Single-Tier Units: Shelf, one double-prong ceiling hook, and two single-prong wall hooks.
   2. Double-Tier Units: Shelf, one double-prong ceiling hook, and two single-prong wall hooks.
   3. Triple-Tier Units: One double-prong ceiling hook, and two single-prong wall hooks.

2.4 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), comply with ASTM A653 galvanizing, suitable for high humidity, exposed applications.

B. Hooks: Zinc plated forged steel, ball ends.

C. Bolts and Nuts: Zinc plated truss fin head bolts and hex nuts.

2.5 FABRICATION

A. Fabricate metal lockers square, rigid, without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.
   1. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.

2. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.

B. Knocked-Down Lockers: Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments.

C. Accessible Lockers: Fabricate as follows:
1. Locate bottom shelf no lower than 15 inches (381 mm) above the floor.
2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches (1219.2 mm) above the floor.

D. Continuous Sloping Tops: Fabricated in lengths as long as practical, without visible fasteners at splice locations; finished to match lockers.
1. Sloping-top corner fillers, mitered.

E. Recess Trim: Fabricated with minimum 2-1/2-inch face width and in lengths as long as practical; finished to match lockers.

F. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip-joint filler angle formed to receive filler panel.

G. Boxed End Panels: Fabricated with 1-inch wide edge dimension, and designed for concealing fasteners and holes at exposed ends of non-recessed metal lockers; finished to match lockers.
1. Provide one-piece panels for double-row (back-to-back) locker ends.

2.6 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Surfaces shall be free of scratches and other serious surface blemishers and chemically clean.

B. Factory Finish: Manufacturer’s standard powder coat primer/topcoat system complying with paint manufacturer's written instructions for cleaning, preparing, pretreating and apply coating to exposed metal surfaces.
1. Color: As selected by Architect from Manufacturer's full range of color options.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, and support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install lockers level, plumb, and true; shim as required, using concealed shims.
1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches (914.4 mm) o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
2. Anchor single rows of metal lockers to walls near top and bottom of lockers.
3. Anchor back-to-back metal lockers to floor.

B. Knocked-Down Lockers: Assemble with standard fasteners, with no exposed fasteners on door faces or face frames.

C. Equipment:
1. Attach hooks with at least two fasteners.
2. Attach door locks on doors using security-type fasteners.
3. Identification Plates: Identify metal lockers with identification indicated on Drawings.

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a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.

D. Trim: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.
1. Attach recess trim to recessed metal lockers with concealed clips.
2. Attach filler panels with concealed fasteners. Locate filler panels where indicated on Drawings.
3. Attach sloping-top units to metal lockers, with closures at exposed ends.
4. Attach boxed end panels using concealed fasteners to conceal exposed ends of non-recessed metal lockers.
5. Attach finished end panels using fasteners only at perimeter to conceal exposed ends of non-recessed metal lockers.

3.3 ADJUSTING

A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding. Verify that integral locking devices operate properly.

3.4 PROTECTION

A. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.

B. Touch up marred finishes or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION

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SECTION 10 56 13 - METAL STORAGE SHELVING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Four post open shelving.

1.3 REFERENCE STANDARDS

A. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.

B. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2025.

C. SSPC-SP 5/NACE No.1 - White Metal Blast Cleaning; 2026.

D. ASTM A513, Type 2 – Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements, for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 - Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 - Product Requirements for substitution procedures.

C. Product Data: For each type of product indicated. Include rated capacities, construction details, material descriptions, dimensions of individual components and profiles, and finishes for metal storage shelving.

D. Shop Drawings: For customized metal storage shelving. Include plans, elevations, sections, details, and attachments to other work. Include installation details of connectors, lateral bracing, and special bracing.

E. Samples for Initial Selection: For units with factory-applied color finishes. Include similar Samples of accessories involving color selection.

F. Product Schedule: For metal storage shelving.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain metal storage shelving from single source from single manufacturer.

1.7 PERFORMANCE REQUIREMENTS

A. Structural Performance for Four-Post Metal Storage Shelving: Capable of withstanding the loads indicated according to MH 28.1.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install metal storage shelving until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Coordinate sizes and locations of blocking and backing required for installation of metal storage shelving attached to wall and ceiling assemblies.

C. Coordinate locations and installation of metal storage shelving that may interfere with ceiling systems including lighting, HVAC, speakers, sprinklers, access panels, electrical switches or outlets, and floor drains.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
   1. Hallowell; Division of List Industries, Inc.

B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
   1. Lyon Workspace Products, LLC.
   2. Penco Products, Inc.
   3. Sandusky Lee Corporation

2.2 MATERIALS

A. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

B. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B.

C. Steel Tubing: ASTM A 513, Type 2.

2.3 FOUR-POST OPEN SHELVING

A. Four-Post Open Storage Shelving: Factory-formed 14-gauge, field-assembled, freestanding system, designed for shelves to span between and be supported by corner posts, with shelves adjustable over the height of shelving unit.

B. Fabricate initial shelving unit with a post at each corner.

C. Provide fixed top and bottom shelves, three (3) adjustable intermediate shelves (for a total of five (5) shelves per unit), and accessories indicated.

D. Load-Carrying Capacity per Shelf: 350 lb.

E. Bracing: Manufacturer's standard, single or double diagonal cross bracing at back and ends; as required for stability, load-carrying capacity of shelves, and number of shelves.

F. Solid-Type Shelves: Fabricated as required for load-carrying capacity per shelf. Fabricate fronts and backs of shelves with box-formed edges, with corners lapped and welded.

G. Size: 36” wide by 18” deep by 84” high and as indicated on drawings.

2.4 FABRICATION

A. Shop Fabrication: Prefabricate shelving components in shop to greatest extent possible to minimize field fabrication; temporarily preassemble shelving components where necessary to ensure that field-assembled components fit together properly. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Fabricate storage shelving square and rigid, with posts plumb and true and shelves flat and free of dents or distortion. Fabricate connections to form a rigid structure, free of buckling and warping.
   1. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.
   2. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Locate joints where least conspicuous.
   3. Build in straps, plates, brackets, and other reinforcements as needed to support shelf loading.
   4. Cut, reinforce, drill, and tap metal fabrications to receive hardware, fasteners, and similar items.

C. Form metal in maximum lengths to minimize joints. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work.

D. Form edges and corners free of sharp edges or rough areas. Fold back and crimp exposed edges of unsupported sheet metal to form a 1/2-inch- wide hem on the concealed side; ease edges of metal plate to radius of approximately 1/32 inch (0.79 mm). Shear and punch metals cleanly and accurately. Remove burrs.

2.5 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No.1, "White Metal Blast Cleaning" or SSPC-SP 8, "Pickling."

D. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry thickness.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine floors for suitable conditions where metal storage shelving will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Vacuum finished floor and wet mop resilient flooring over which metal storage shelving is to be installed.

3.3 INSTALLATION

A. Install metal storage shelving level, plumb, square, rigid, true, and with shelves flat and free of dents or distortion. Make connections to form a rigid structure, free of buckling and warping.

B. Install exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.

C. Install braces, straps, plates, brackets, and other reinforcements as needed to support shelf loading and as required for stability.

D. Adjust post-base bolt leveler to achieve level and plumb installation.

E. Connect side-to-side and back-to-back shelving units together.

F. Install shelves in each shelving unit at spacing indicated on drawings or, if not indicated, at equal spacing.

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G. Four-Post Metal Storage Shelving: Install four clips, one at each post, for support of each shelf; with clips fully engaged in post perforations.

3.4 ERECTION TOLERANCES

A. Erect four-post metal storage shelving to a maximum tolerance from vertical of 1/2 inch (12.7 mm) in up to 10 feet (304.8 cm) of height, not exceeding 1 inch (25.4 mm) for heights taller than 10 feet.

3.5 ADJUSTING

A. Adjust metal storage shelving so that connectors and other components engage accurately and securely.

B. Touch up marred finishes or replace metal storage shelving that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by metal storage shelving manufacturer.

C. Replace metal storage shelving that has been damaged or has deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 10 73 16.13 - METAL CANOPIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Attached metal canopies.

1.3 REFERENCE STANDARDS

A. AAMA 611 - Specification for Anodized Architectural Aluminum; 2026.

B. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

C. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.

D. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

F. ASTM B308/B308M - Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles; 2020.

G. ASTM B429/B429M - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube; 2020.

H. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2020.

I. ASTM E2950 - Standard Specification for Metal Canopy Systems; 2014 (Reapproved 2020).

J. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs; 2022.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements, for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 - Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 - Product Requirements for substitution procedures.

C. Product Data: Submit product data sheets, including material descriptions and finishes, and preparation instructions and recommendations.

D. Shop Drawings: Prior to commencement of fabrication, submit detailed shop drawings, showing profiles, sections of components, finishes, and fastening details.

E. Design Data: Submit comprehensive structural analysis of design for the specified loads. Stamp and sign calculations by professional engineer.

F. Designer's Qualification Statement.

G. Manufacturer's Qualification Statement.

H. Erector's Qualification Statement.

I. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

J. Exterior Product Approvals: Manufacturer shall submit documentation that product complies with large and small missile impact criteria and has been tested and approved in compliance with Florida Product Approval or Miami Dade NOA and applicable requirements.

1.6 QUALITY ASSURANCE

A. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in Florida.
   1. Comply with applicable code for submission of design calculations as required for acquiring permits.
   2. Cooperate with regulatory agency or authorities having jurisdiction (AHJ), and provide data as requested.

B. Manufacturer Qualifications: Company specializing in the manufacture of products similar to those required for this project.
   1. Not less than three years of documented experience.

C. Erector Qualifications: Company specializing in performing the work of this section.
   1. Not less than three years of documented experience and approved by canopy manufacturer.

D. Exterior Product Approvals: Manufacturer shall certify that product complies with large and small missile impact criteria and has been tested and approved in compliance with Florida Product Approval or Miami Dade NOA and applicable requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site ready for erection.

B. Package using methods that prevent damage during shipping and storage on site.

C. Store materials under cover and elevated above grade.

1.8 WARRANTY

A. Metal Canopies: Correct defective work within a two year period after Date of Substantial Completion.

B. Finish Warranty: Provide manufacturer's one year warranty on factory finish against cracking, peeling, and blistering.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
   1. PeachTree Protective Covers: https://peachtreecovers.com
   2. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
      a. Mapes Industries; Super Lumideck: https://mapes.com
      b. Columbus Awning Company: www.columbusawningcompany.com
      c. FORM by KSC: https://formmetal.com

2.2 METAL CANOPIES

A. Shop Fabricated Aluminum Canopy

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B. Configuration: Layout and dimensions, column layout, canopy clearance, fascia profile, and roof covering design as indicated on drawings.
   1. Installation: Cantilever-mounted to building structure with tension members.
   2. Structural Framing System: Aluminum.
   3. Covering Material: Aluminum.
   4. Drainage Concept: As illustrated on Drawings.

C. Performance Requirements:
   1. Design and fabricate metal canopy system to resist wind, snow, live, and seismic loads without failure, damage, or permanent deflection in accordance with ASCE 7:
      a. Loads: As indicated on drawings.
   2. Thermal Movement: Design canopy system to accommodate thermal movement caused by ambient temperature range of 120 degrees F (49 degrees C) and surface temperature range of 180 degrees F (82 degrees C) without buckling, failure of joint seals, undue stress on fasteners or other detrimental effects on assembly components.

2.3 COMPONENTS

A. Structural Aluminum Framing: Alloy and temper 6063-T5, 6063-T6, or 6061-T6.
   1. Extruded Shapes and Tubes: ASTM B221 (ASTM B221M).
   2. Rolled or Extruded Structural Shapes: ASTM B308/B308M.
   3. Extruded Structural Pipe and Tube: ASTM B429/B429M.
   4. Sheet and Plate: Alloy 5052, 5005, or 6061-T651, ASTM B209/B209M.

B. Covering:
   1. Aluminum Decking:
      a. Interlocking extruded aluminum decking modules.
         1) Extruded Decking: ASTM B221 (ASTM B221M) - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; Alloy and temper 6063-T6.
            (a) Extrusion Size: 3 inch extruded.
            (b) Thickness: 0.078 inches.
      b. Decking Orientation: As indicated on drawings.
   2. Overhang depth: As indicated on drawings.

C. Fascia: Same material as structural framework, 6 inches (152 mm) high.
   1. Profile: As indicated on Drawings.
   2. Thickness: 0.125 inches.

D. Fascia: Manufacturer's standard profile.
   1. Material: Extruded Aluminum.

2.4 SHOP FABRICATION

A. Provide a complete system ready for erection at project site.

B. Shop fabricate to the greatest extent possible; disassemble if necessary for shipping.

C. Fabricate connections for bolt, nut, and washer connectors.

2.5 FINISHES

A. Aluminum Framing and Decking: Satin Anodized.

B. Fascia: Satin anodized .

2.6 ACCESSORIES

A. Trim, Closure Pieces, and Flashings: Same material and finish as sheet metal decking; factory-fabricated to required profiles.
   1. Exposed Fasteners: Stainless steel.

B. Hangar rods: Powder coated to match canopy color.

C. Grout: ASTM C1107/C1107M; non-shrinking; premixed compound consisting of non-metallic aggregate, cement, water-reducing and plasticizing agents.

D. Fasteners, Non-Structural: ASTM F593 stainless steel or ASTM A307 carbon steel.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and site area for conditions that might prevent satisfactory installation.

B. Verify that foundation, electrical utilities, and placed anchors are in correct position.

C. Verify that bearing surfaces are ready to receive this work.

D. Do not proceed with installation until all conditions are satisfactory.

3.2 INSTALLATION - FRAMING

A. Erect framing in accordance with AISC 303.

B. Provide for erection and wind loads. Provide temporary bracing to maintain structure plumb and in alignment until completion of erection and installation.

C. Set column base plates with non-shrink grout to achieve full plate bearing.

D. Fasten columns to anchor bolts.

E. Do not field cut or alter structural members without approval.

F. After erection, prime welds, abrasions, and surfaces not shop primed.

3.3 INSTALLATION - CANOPY COVERING

A. Install in accordance with manufacturer's instructions.

B. Fasten metal decking to metal support members, aligned level and plumb.

C. Install fascia panels, trim, and flashing.

D. Separate dissimilar metals using concealed bituminous paint.

E. Touch-up damaged finish coating using material provided by manufacturer to match original coating.

3.4 TOLERANCES

A. Maximum Variation from Level: Plus/Minus 1/8 inch (3.175 mm).

3.5 CLEANING

A. Clean surfaces of dust and debris; follow manufacturer's cleaning instructions for the finish used.

3.6 PROTECTION

A. Protect canopy after installation to prevent damage due to other work until Date of Substantial Completion.

END OF SECTION

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SECTION 10 73 26 - WALKWAY COVERINGS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Aluminum walkway canopy system.
   2. Accessories.

1.3 REFERENCE STANDARDS

A. AAMA 611 - Specification for Anodized Architectural Aluminum; 2026.

B. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

C. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

D. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

E. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

F. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

G. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2024.

H. ASTM B 209 – Specification for Aluminum and Aluminum- Alloy Sheet and Plate.

I. ASTM B221 – Specification for Aluminum and Aluminum- Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

J. ASTM C 150 – Specification for Portland Cement.

K. American Welding Society (AWS).

L. ANSI/AWS D1.2 – Structural Welding Code - Aluminum.

M. ASTM B206 – Aluminum and Aluminum-Alloy Sheet and Plate.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 – Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 – Product Requirements for substitution procedures.

C. Product Data: Submit manufacturers published product data for metal items being incorporated into the Work.

D. Shop Drawings:

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1. Submit customary and complete shop drawings for proposed miscellaneous metal items requiring shop fabrications.
2. Shop Drawings shall consist of plans and elevations at not less than 1 inch (25.4 mm) to 1-foot scale and include details of sections and connections at not less than 3 inches (76.2 mm) to 1-foot scale.
3. Show anchorage and accessory items. Show all expansion joint locations and details. Provide templates for anchor and bolt installation by others.
4. Detail all anticipated mechanical joints and show locations on plans.

E. Submit color samples of material finishes for Architect's selection.

F. Delegated-Design Submittal: Submit design calculations, footing design, analysis data and shop drawings indicating compliance with dedicated design requirements signed and sealed by the qualified Florida registered professional engineer responsible for their preparation.

G. Approvals: Manufacturer shall submit documentation that product complies with and has been tested and approved in compliance with Florida Product Approval or Miami Dade NOA and applicable requirements.

H. Installer’s Certification from manufacturer.

1.6 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Provide products from a firm that makes the indicated products as a regular production item and with not less than ten (10) years experience.

B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation of specified materials and assemblies with not less than five (5) years experience.

C. System to be designed to provide positive drainage in all conditions.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and protect products as instructed by manufacturer.

B. Promptly inspect shipment to assure the products comply with requirements, quantities are correct, and products are undamaged.

C. Stack the materials to prevent twisting, bending, or abrasion, and to provide ventilation.
1. Slope metal sheets to ensure drainage.

D. Prevent contact with materials during storage, which may cause discoloration or staining.

1.8 WARRANTY

A. Manufacturer’s Warranty: Provide manufacturer’s written warranty to repair or replace components of the system that fail within a one (1) warranty period. Warranty shall include all costs for materials required to perform repairs.

B. Installer’s Warranty: Provide installer’s written warranty to repair or replace components of the system that fail due to workmanship within the indicated warranty period. Warranty shall include all costs for parts and labor required to perform repairs.
1. Warranty Period: Not less than two (2) years from Date of Substantial Completion.

1.9 PERFORMANCE REQUIREMENTS

A. Approvals: Manufacturer shall certify that product complies with and has been tested and approved in compliance with Florida Product Approval or Miami Dade NOA and applicable requirements.

B. Delegated-Design: Provide delegated design services including calculations and shop drawings for load bearing items to comply with performance requirements, applicable code requirements and design criteria signed and sealed by an engineer registered in the State of Florida.
1. Walkway covering manufacturer shall also design all required footings and reinforcing by Code and all connections in accordance with the Florida Building Code as part of the delegated-design.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
   1. PeachTree Protective Covers: https://peachtreecovers.com

B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
   1. Dittmer Architectural Aluminum
   2. Perfection Architectural Systems, Inc.
   3. Mitchell Metals, LLC.

2.2 SYSTEM

A. Work shall include the structural tubular aluminum beams, columns, canopy downspouts, and their placement within the concrete and masonry columns supporting the canopies.

B. Water Drainage: Water shall drain internally from the deck into the beams into pre-determined columns for discharge into underground storm water drainage system unless indicated otherwise on the drawings.

C. Bent Construction: Beams and columns shall be welded into one-piece rigid bents in the factory. Extruded structural ties shall be installed rigidly on top of all beam sections and shall also serve as closures between draining deck sections. Bents shall have with downspouts, flange, anchors, sleeves, as required for a complete and working installation.
   1. Mechanical slip joints may be used for shipping purposes. Field weld seams after erection.
   2. Bents shall be 4 x 4 minimum columns and beams shall be 4 x 6 minimum.

D. Roof Deck: Extruded roof deck sections shall be composed of interlocking and self-flashing sections. Self-flashing and interlocking joints shall be fastened rigidly with fastenings as shown on shop drawings.
   1. Deck: 3-inch high by 6-inch wide profile (nominal) minimum.
   2. Expansion Joints: Structure shall be designed for temperature changes of 120 degrees Fahrenheit (48.89 degrees Celsius) with expansion joints provided if required. Expansion joints shall have no metal-to-metal contact.

E. Beams: Provide open-top tubular extrusion. top edges thickened for strength and designed to receive deck members in self-flashing manner.

F. Deck: Extruded self-flashing sections interlocking into a composite unit. Provide welded plate closures at deck ends.

G. Fascia: Manufacturer's standard shape. Provide fascia splices where continuous runs of fascia are jointed. Locate splices to be in line with bents and fasten in place on hidden or non-vertical surfaces.

H. Erection: In accordance with manufacturer’s approved shop drawings. All bents shall be straight and true prior to placing concrete. Aluminum columns embedded in concrete shall be protected with 2 coats clear acrylic. Protect components from damage during installation and subsequent Work.

I. Complete system shall be rigid frame with a water-tight internal drainage system.

2.3 MATERIALS

A. Extruded Aluminum: ASTM B221 6063-T6 alloy, T6 Temper.

B. Gaskets: Dry seal santoprene pressure type.

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C. All fasteners shall be 18-8 or 300 Series stainless steel (screws, bolts, rivets, etc.).

D. Grout: Grout shall be 2000 P.S.I. minimum compressive strength.

E. Gaskets: Gaskets shall be dry seal santoprene elastomer pressure type.

2.4 FABRICATION

A. Beams and columns shall be factory welded with mitered corners into one-piece rigid bents.
   1. Welds shall be smooth and uniform using inert gas shielded arc, with 100% penetration.
   2. Grind welds only where interfering with adjoining structure to allow a flush connection.

B. Field welding is not permitted, use rigid mechanical joints when shipping limitations exist.

C. Deck shall be roll formed modules that interlock to form a self-flash condition.
   1. Positively fasten interlocking joints to form a monolithic structural unit to develop the full strength of the sections.
   2. Assemble the deck with sufficient camber to offset dead load deflection.

2.5 FINISH

A. Aluminum Surfaces: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Sections shall be free of scratches and other serious surface blemishes and chemically cleaned.

B. Aluminum Surfaces: Sections shall be free of scratches and other serious surface blemishes and chemically cleaned.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Clear Anodic Finish: Class 1, AAMA 2605, AA-M12C22A41, Mechanical finish, nonspecular as fabricated, chemical finish, 0.7 mils (0.01778 mm) or thicker.

PART 3 EXECUTION

3.1 INSPECTION, PREPARATION, AND INSTALLATION

A. Canopy manufacturer shall examine surfaces prior to the start of installation. Deviations from the approved shop drawings shall be brought to the attention of the Contractor at once.

B. Aluminum surfaces that are to come in contact with dissimilar materials shall be protected with one coat of asphaltic emulsion paint in addition to factory protection.

C. Erection of the canopies shall be completed by an installer approved by the manufacturer in accordance with approved shop drawings.

D. Only specialized mechanics having at least two (2) years experience in this type of work shall be employed in the erection of the canopies.

END OF SECTION

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SECTION 10 75 00 - FLAGPOLES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Ground-mounted flagpoles made from aluminum.
   2. Flagpole light
   3. Accessories

1.3 REFERENCE STANDARDS

A. AAMA 611 - Specification for Anodized Architectural Aluminum; 2026.

B. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

F. ASTM B241/B241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube; 2022.

G. AASHTO M246/M246M – Standard Specification for steel sheet, metallic-coated and polymer pre-coated for corrugated steel pipes.

H. ASTM A790/A790M – Standard Specification for Seamless and Welded Ferrite/Austenitic Stainless-Steel Pipe.

I. CDA (Copper Development Association) – Handbook.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements, for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 - Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 - Product Requirements for substitution procedures.

C. Product Data: Provide product data on pole, accessories, and configurations.

D. Shop Drawings: Include plans, elevations, details, and attachments to other work. Show general arrangement, jointing, fittings, accessories, grounding, anchoring, and support.
   1. Include section, and details of foundation system for ground-mounted flagpoles
   2. Provide engineered shop drawings indicate detailed dimensions, base details, anchor requirements, and imposed loads.

E. Delegated-Design Submittal: Contractor shall engage a qualified professional engineer, licensed in the State of Florida, to design calculations, analysis data, and shop drawings -

indicating compliance with dedicated design requirements, and signed and sealed by the qualified Florida registered professional engineer responsible for their preparation.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain flagpole as complete unit, including fittings, accessories, bases, and anchorage devices, from single source from single manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. General: Spiral wrap flagpoles with heavy paper and enclose in a hard fiber tube or other protective container.

1.8 PERFORMANCE REQUIREMENTS

A. Structural Performance: Flagpole assemblies, including anchorages and supports, shall withstand the effects of gravity loads, and the following loads and stresses within limits and under conditions indicated according to the following design criteria:
   1. Wind Loads: As indicated on structural drawings and in compliance with FBC and ASCE 7.
   2. Base flagpole design on polyester flags of maximum standard size suitable for use with flagpole or flag size indicated, whichever is more stringent.

B. Delegated-Design: Contractor shall engage a qualified professional engineer, licensed in the State of Florida, to design calculations, analysis data, and shop drawings - indicating compliance with dedicated design requirements, and signed and sealed by the qualified Florida registered professional engineer responsible for their preparation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
   1. American Flagpole; a Kearney-National Inc. company.

B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
   1. Eder Flag Manufacturing Company, Inc.
   2. U.S. Flag & Flagpole Supply, LP.
   3. Concord Industries, Inc.
   4. Pole-Tech Co., Inc.

2.2 FLAGPOLES

A. Flagpole Construction, General: Construct flagpoles in one piece if possible. If more than one piece is necessary, comply with the following:
   1. Fabricate shop and field joints without using fasteners, screw collars, or lead calking.
   2. Provide flush hairline joints using self-aligning, snug-fitting, internal sleeves.

B. Exposed Height: 30 feet (914.4 cm).

C. Aluminum Flagpoles: Provide one-piece cone tapered flagpoles fabricated from seamless extruded tubing complying with ASTM B241/B241M, Alloy 6063, with a minimum wall thickness of 3/16 inch (4.76 mm).

D. Metal Foundation Tube: Manufacturer's standard corrugated-steel foundation tube, not less than 0.064-inch nominal wall thickness. Provide with 3/16-inch steel bottom plate and support plate; 3/4-inch diameter, steel ground spike; and steel centering wedges welded together.

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Galvanize steel to G90 after assembly. Provide loose hardwood wedges at top of foundation tube for plumbing pole.

1. Provide flashing collar of same material and finish as flagpole.
2. Interior Finish: Treat the interior to prevent corrosion.
3. Lightning Ground Rod: Copper 3/4” diameter rod of a designed length for grounding.

E. Cast-Metal Shoe Base: Provide units made from aluminum with same finish and color as flagpoles. For anchor-bolt mounting; provide with anchor bolts.

F. Flagpole Interior Finish: Treat the interior to prevent corrosion.

G. Quantity: Two (2) poles.

2.3 FITTINGS

A. Finial Ball: Manufacturer's standard 6” diameter spun aluminum flush-seam ball, match flagpole-butt diameter and with gold anodic finish.
   1. 0.063-inch spun aluminum with gold anodic finish.

B. Internal Halyard, Winch System: Manually operated winch with control stop device and removable handle, stainless-steel cable halyard, and concealed revolving truck assembly with plastic-coated counterweight and sling. Furnish flush access door secured with cylinder lock. Finish truck assembly to match flagpole.

C. Halyard Flag Snaps: Provide four stainless steel swivel snap hooks per halyard to accommodate two flags, provide with neoprene or vinyl covers.

2.4 FLAGS

A. Provide one USA flag, 8 x 5 feet (152.4 cm) size, nylon fabric, brass grommets, and hemmed edges.

B. Provide one Florida State flag, 8 x 5 feet (152.4 cm) size, nylon fabric, brass grommets, and hemmed edges.

2.5 MISCELLANEOUS MATERIALS

A. Fasteners: Provide Type 316 stainless-steel fasteners for exterior use.

B. Non-shrink, Nonmetallic Grout: Factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C 1107.

C. Drainage Material: Crushed stone or crushed or uncrushed gravel; coarse aggregate.

D. Sand: ASTM C 33, fine aggregate.

E. Elastomeric Joint Sealant: Single-component neutral- and basic-curing silicone joint sealant complying with requirements in specification section "Joint Sealants" for Use NT (non-traffic) and for Use M, G, A, and, as applicable to joint substrates indicated, for Use O.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.6 FINISH

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Aluminum
   1. Flag Pole Finish: Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0 inch (0.01 mm) or thicker.
   2. Finial Ball Finish: Gold Anodic Finish: AAMA 611, AA-M32C22A43 Class I, 0 inch (0.02 mm) or thicker; gold color.

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D. Steel Finishes
   1. Flagpole Interior Finish: Apply one coat of bituminous paint on interior of flagpole or otherwise treat to prevent corrosion.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, including foundation; accurate placement, pattern, orientation of anchor bolts, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare uncoated metal flagpoles that are set in foundation tubes by painting below-grade portions with a heavy coat of bituminous paint.

B. Foundation Excavation: Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete. Place and compact drainage material at excavation bottom.

C. Provide forms where required due to unstable soil conditions and for perimeter of flagpole base at grade. Secure and brace forms to prevent displacement during concreting.

D. Place concrete, as specified in Specification Section "Cast-in-Place Concrete." Compact concrete in place by using vibrators. Moist-cure exposed concrete for not less than seven days or use non-staining curing compound.

E. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to perimeter of concrete base.

3.3 FLAGPOLE INSTALLATION

A. General: Install flagpoles where shown and according to Shop Drawings and manufacturer's written instructions.

B. Ground Set: Place foundation tube, center, and brace to prevent displacement during concreting. Place concrete. Plumb and level foundation tube and allow concrete to cure. Install flagpole, plumb, in foundation tube.

C. Foundation Tube: Place tube seated on bottom plate between steel centering wedges and install hardwood wedges to secure flagpole in place. Place and compact sand in foundation tube and remove hardwood wedges. Seal top of foundation tube with a 2-inch layer of elastomeric joint sealant and cover with flashing collar.

D. Baseplate: Cast anchor bolts in concrete foundation. Install baseplate on washers placed over leveling nuts on anchor bolts and adjust until flagpole is plumb. After flagpole is plumb, tighten retaining nuts and fill space under baseplate solidly with non-shrink, nonmetallic grout. Finish exposed grout surfaces smooth and slope 45 degrees away from edges of baseplate.

END OF SECTION

SECTION 11 66 23 - GYMNASIUM EQUIPMENT

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Gymnasium equipment:
   1. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
      a. Safety pads
         1) Wall safety pads.
         2) Pad coverings.

1.3 REFERENCE STANDARDS

A. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications; 2022.

B. ASTM F2440 - Standard Specification for Impact Attenuation of Wall Padding Used in Indoor Competitive and Recreational Sports Venues; 2024.

C. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2024.

E. PS 1 - Structural Plywood; 2023.

F. NFHS – The National Federation of State High School Associations.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 – Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 – Product Requirements for substitution procedures.

C. Product Data: For each type of product indicated.
   1. If applicable, include assembly, disassembly, and storage instructions for removable equipment.
   2. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.

D. Shop Drawings: For gymnasium equipment. Include plans, elevations, sections, details, attachments to other work, and the following:
   1. Method of field assembly for removable equipment, connections, installation details, mountings, floor inserts, attachments to other work, and operational clearances.
   2. Transport and storage accessories for removable equipment.

E. Structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation including loads, point reactions, and locations for attachment of gymnasium equipment to structure.

F. Coordination Drawings: Court layout plans, drawn to scale, and coordinating floor inserts, game lines, and markers applied to finished flooring.

G. Samples for Initial Selection: For each type of gymnasium equipment indicated.

H. Product Certificates: For each type of gymnasium equipment, signed by product manufacturer.

I. Qualification Data: For Installer.

J. Operation and Maintenance Data: For gymnasium equipment to include in emergency, operation, and maintenance manuals.

K. Warranty: Special warranty specified in this Section.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain each type of gymnasium equipment through one source from a single manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install gymnasium equipment until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Verify position and elevation of floor inserts and layout for gymnasium equipment.

C. Coordinate installation of floor inserts with structural floors and finish flooring installation and with court layout and game lines and markers on finish flooring.

D. Coordinate layout and installation of overhead-supported gymnasium equipment and suspension system components with other construction including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

1.8 WARRANTY

A. Special Warranty: Basketball equipment manufacturer's standard form in which manufacturer agrees to repair or replace components of athletic equipment that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: As indicated below from date of Substantial Completion.
      a. Safety Pads: Five (5) years.

1.9 PERFORMANCE REQUIREMENTS

A. General: Provide equipment complying with NFHS’s requirements.

PART 2 PRODUCTS

2.1 SAFETY PADS

A. Safety Mats
   1. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
      a. AALCO Manufacturing.
   2. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
      a. Performance Sports Systems.
      b. Porter Athletic Equipment Company.

B. Safety Pad Burning Characteristics: Must furnish test results for NFPA 286 or other full-scale fire test as required by NFPA 101.

C. Pad Coverings: Provide safety pad fabric covering fabricated from puncture- and tear-resistant, not less than 19-oz./sq. yd PVC-coated polyester or nylon-reinforced PVC fabric treated with fungicide for mildew resistance; with surface-burning characteristics indicated, and lined with fire-retardant liner.

D. Wall Safety Pads: Padded wall wainscot panels designed to be attached in a continuous row; each panel section consisting of fill laminated to backer board with visible surfaces fully covered by seamless fabric covering, free of sag and wrinkles and firmly attached to back of backer board.

E. Impact Criteria: Must comply with ASTM F2440 Impact Criteria.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
   1. Extruded Bars, Profiles, and Tubes: ASTM B221 (ASTM B221M).
   2. Cast Aluminum: ASTM B179.
   3. Flat Sheet: ASTM B 209 (ASTM B 209M).

B. Steel: Comply with the following:
   1. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
   2. Steel Tubing: ASTM A 500 or ASTM A 513, cold formed.
   3. Steel Sheet: ASTM A1011/A1011M.

C. Softwood Plywood: DOC PS 1, exterior.

D. Medium-Density Fiberboard: ANSI A208.2

E. Anchors, Fasteners, Fittings and Hardware: Manufacturer's standard corrosion-resistant or non-corrodible units; concealed.

F. Grout: Non-shrink, nonmetallic, premixed, factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C1107 with minimum strength recommended in writing by gymnasium equipment manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for play court layout, alignment of mounting substrates, installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance.
   1. Verify critical dimensions.
   2. Examine supporting structure and subgrades, subfloors and footings below finished floor.
   3. Examine wall assemblies, where reinforced to receive anchors and fasteners, to verify that locations of concealed reinforcements have been clearly marked. Locate reinforcements and mark locations.
   4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Comply with manufacturer's written installation instructions and competition rules indicated for each type of gymnasium equipment. Complete equipment field assembly, where required.

B. Unless otherwise indicated, install gymnasium equipment after other finishing operations, including painting, have been completed.

C. Permanently Placed Gymnasium Equipment and Components: Rigid, level, plumb, square, and true; anchored securely to supporting structure; positioned at locations and elevations indicated on Shop Drawings; in proper relation to adjacent construction; and aligned with court layout.
   1. Floor Insert Location: Coordinate location with application of game lines and markers.

2. Floor Insert Elevation: Coordinate installed heights of floor insert with installation and field finishing of finish flooring and type of floor plate.

D. Floor Insert Setting: Position sleeve in oversized, recessed voids in concrete slabs. Clean voids of debris. Fill void around sleeves with grout, mixed and placed to comply with grout manufacturer's written instructions. Protect portion of sleeve above subfloor and footing from splatter. Verify that sleeves are set plumb, aligned, and at correct height and spacing; hold in position during placement and finishing operations until grout is sufficiently cured. Set insert so top surface of completed unit is flush with finished flooring surface.

E. Wall Safety Pads: Mount with bottom edge at 4 inches (101.6 mm) above finished floor.

F. Anchoring to In-Place Construction: Use anchors and fasteners where necessary for securing built-in and permanently placed gymnasium equipment to structural support and for properly transferring load to in-place construction.

3.3 CLEANING

A. After completing gymnasium equipment installation, inspect components. Remove spots, dirt, and debris and touch up damaged shop-applied finishes according to manufacturer's written instructions.

B. Replace gymnasium equipment and finishes that cannot be cleaned and repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION

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SECTION 12 24 13 - ROLLER WINDOW SHADES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, materials, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Manual operated roller shade with single rollers (WS-1).

1.3 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.

B. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

C. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2023, with Errata.

D. WCMA A100.1 - Standard for Safety of Window Covering Products; 2022.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements, for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 - Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 - Product Requirements for substitution procedures.

C. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

D. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.
   1. Motor-Operated Shades: Include details of installation and diagrams for power, signal, and control wiring.

E. Samples: For each exposed product and for each color and texture specified, 10 inches (254 mm) long.
   1. Shadeband Material: Not less than 10 inches (254 mm) square. Mark interior face of material if applicable.
   2. Roller Shade: Full-size operating unit, not less than 16 inches (406.4 mm) wide by 36 inches (914.4 mm) long for each type of roller shade indicated.
   3. Installation Accessories: Full-size unit, not less than 10 inches (254 mm) long.

F. Product Data: Submit manufacturer's product data, installation instructions and general recommendations for each specified material and fabricated product. Unless otherwise indicated, submit the following for each type of product provided under work of this section for recycled content:

G. Paints, primers, coatings, and adhesives for or site installation or factory fabrication:
   1. Submit manufacturer’s product data for paints, primers, coatings, and adhesives as indicated.
   2. Indicate VOC limits of the product. Submit MSDS highlighting VOC limits.

3. Submit manufacturer's certification that products comply with VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

H. Qualification Data: For Installer.

I. Product Certificates: For each type of shadeband material.

J. Product Test Reports:
1. Fire-Test-Response Characteristics: Passes NFPA 701-99 small and large-scale vertical burn. Materials tested shall be identical to products proposed for use.
2. Anti-Microbial Characteristics: 'No Growth' per ASTM G21 results for fungi ATCC9642, ATCC 9644, ATCC9645

K. Operation and Maintenance Data: For roller shades to include in maintenance manuals.

1.6 ATTIC STOCK

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Roller Shades:
a. Fabric equal to 5 percent of quantity installed for each color, and shadeband material indicated.
b. Brackets equal to 5 percent of quantity installed for each type on project.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.10 WARRANTY

A. Roller Shade Hardware and Shadecloth: Manufacturer's standard non-depreciating twenty-five (25) year limited warranty.

B. Roller Shade Motors and Motor Control Systems: Manufacturer's standard non-depreciating five (5) year warranty extended to eight years if turn key wired.

C. Roller Shade Installation: One year from date of substantial completion, not including scaffolding, lifts, and other means of access.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
1. MechoShade Systems, Inc.: www.mechoshade.com

B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
   1. Insoltroll Window Shading Systems.
   2. SWF Contract.
   3. Draper, Inc.

2.2 MANUALLY OPERATED SHADES WITH SINGLE-ROLLERS (WS-1)

A. Basis of Design Product: “Mecho 5” Light Filtering or Light Blocking as indicated.

B. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.
   1. Bead Chains: Stainless steel
      a. Loop Length: Full length of roller shade except at clerestory windows where chain will stop 48” inches above finished floor, to be verified with the Architect.
      b. Limit Stops: Provide upper and lower ball stops.
      c. Chain-Retainer Type: Standard Clip
   2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller-shade weight and lifting heavy roller shades.
      a. Provide for shadebands that weigh more than 12 lb. or for shades as recommended by manufacturer, whichever criteria are more stringent.

C. Rollers: Corrosion-resistant extruded-aluminum tubes of diameters and wall thicknesses required for accommodating operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
   1. Roller Drive-End Location: As indicated on Drawings.
   2. Direction of Shadeband Roll: Regular, from back of roller.
   3. Shadeband-to-Roller Attachment: Removable spline fitting integral channel in tube.

D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
   1. Brackets: Constructed of minimum 1/8-inch thick plated steel or heavier as required to support 150 percent of the full weight of each shade.
   2. Plastics: Provide self–lubricating plastic for all plastic components of shade hardware.

E. Shadebands:
   1. Shadeband Material: Light filtering fabric or light blocking as indicated.
   2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
   3. Type: Enclosed in sealed pocket of shadeband material.

F. Installation Accessories:
   1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
      a. Shape: L-shaped.
      b. Height: Manufacturer's standard height required to conceal roller and shadeband when shade is fully open.
      c. Endcap Covers: To cover exposed endcaps.
      d. Installation Accessories Color and Finish: As selected from manufacturer's full range.
   2. Side Channels: To be installed at light blocking shades only.
      a. Extruded aluminum with polybond edge seals and SnapLoc-mounting brackets and with concealed fastening. Exposed fastening is not acceptable.
      b. Color: Selected from manufacturer's standard colors.

G. Location: See drawings for blind locations.

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2.3 SHADEBAND MATERIALS

A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Identify products with appropriate markings of applicable testing agency.

B. Light-Filtering Fabric:
   1. Basis of Design Product: Refer to "Finish Color Summary Chart" on Drawings for product selection.
   2. Woven fabric, stain and fade resistant.
   3. Color: As indicated on Drawings.
   4. Openness Factor: 3 percent.

2.4 ROLLER-SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:

C. Provide multi-band shades to provide the maximum allowable width to accommodate operation by a single unit.

D. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible except as follows:
   1. One batten seam will be required for stability on shades taller than fifteen feet to be placed as indicated by Architect.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER-SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions on inside face of mullion unless indicated otherwise.
   1. Opaque Shadebands: Located so shadeband is not closer than 2 inches (50.8 mm) to interior face of glass. Allow clearances for window operation hardware.

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean roller-shade surfaces after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION

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SECTION 12 66 13 - TELESCOPING BLEACHERS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Telescoping bleachers.

B. Electric motor operators, controls, and internal wiring.

1.3 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2022.

C. ASTM D1929 - Standard Test Method for Determining Ignition Temperature of Plastics; 2023.

D. ASTM D2843 - Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics; 2022.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

F. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021, with Errata (2023).

G. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025, with Errata (2026).

H. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2025, with Errata (2026).

I. NFPA 102 - Standard for Grandstands, Folding and Telescopic Seating, Tents, and Membrane Structures; 2026.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements, for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 - Administrative Requirementsfor submittal procedures.

B. Refer to Section 01 60 00.0 - Product Requirements for substitution procedures.

C. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage handling and requirements.
   3. Installation methods.

D. Shop Drawings: Complete layout with dimensions, seat heights, row spacing and rise, aisle widths and locations, points of connection to substrate, assembly dimensions, and material types and finishes.
   1. Provide drawings customized to this project.
   2. Include Professional Engineer certification.
   3. Wiring Diagrams: Show locations of motors, electrical wiring, and rough-in connections.
   4. Graphics Layout Drawings: Indicate pattern of seat colors.

E. Selection Samples: For each material for which color selection is required, submit samples, 2 by 2 inches (50 by 50 mm) in size, illustrating colors and finishes available.

F. Verification Samples: For each custom colored finish, submit samples of actual finish or product, for verification of color selection.

G. Operation and Maintenance Data: Manufacturer's operation and maintenance instructions, including annual inspection and maintenance and bi-annual inspection by a Professional Engineer or manufacturer factory service personnel.

H. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

I. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Manufacturer's installation crew.

C. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M, AWS D1.3/D1.3M, and no more than 12 months before the start of scheduled welding work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store, in original packaging, under cover and elevated above grade.

1.8 WARRANTY

A. Correct defective Work within a five year period after Date of Substantial Completion. Replace parts that fail under normal use at no extra charge to Owner.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Telescoping Bleachers:
   1. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
      a. Hussey Seating Company: www.husseyseating.com

2.2 TELESCOPING BLEACHERS

A. Basis of Design Product: "MAXAM" series.

B. Row spacing: As indicated on Drawings.

C. Telescoping Bleachers: Factory assembled tiered benches that retract horizontally into depth approximately the same as a single row depth, with fixed seats mounted on leading edge of platforms.
   1. Design to comply with applicable requirements of NFPA 102 and requirements of code authorities having jurisdiction; where conflicts between requirements occur, comply with whichever is more stringent.
   2. Design with solid fascia (riser) or seat fronts that conceal interior mechanisms when fully retracted, fitting tightly enough to prevent climbing up face; at front row provide key locked, hinged fascia (skirt) to cover gap between seat riser/fascia and floor.
   3. Standard Extension: Top row fixed to floor, adjacent to wall under overhang, forward extension (away from wall); attachment to wall acceptable.
   4. Reverse Extension: Front row fixed to floor, extension from front to back.
   5. Configurations: As indicated on drawings.

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6. Wheelchair Spaces: Permanent open spaces at locations indicated on drawings in compliance with ADA Standards.
7. Wheelchair Spaces: Allow portions of first row, as indicated, to be manually retracted without affecting other rows; provide removable railings at row two behind wheelchair spaces in compliance with ADA Standards.
8. Wheelchair Spaces: Comply with ADA Standards as required for project.
9. Cutouts: Fit units to irregular wall surfaces, columns, pilasters, roof drain leaders, and other obstructions; take field measurements prior to fabrication.
10. Operation: Motor operated.

D. Design Loads: Design to withstand the following loading conditions:
1. Live Load on Structural Supports: 100 psf (4.8 kPa), minimum, of gross horizontal projection.
2. Live Load on Seats and Walking Surfaces: 120 pounds per linear foot (1750 N/m).
3. Lateral Sway Stress on Structural Supports: 24 pounds per linear foot (350 N/m) of seat plank.
4. Perpendicular Sway Stress on Structural Supports: 10 pounds per linear foot (146 N/m) of seat plank.

E. Dimensions:
1. See Drawings for overall dimensions.
2. Rows: 7.
3. Rise Per Row: 10 inches (254 mm).
4. Row Depth: 26 inches (660 mm).
5. Seat Height Above Tread: 6 inches (150 mm).

F. Structural Supports: Steel or aluminum; manufacturer's standard wheeled carriages supporting each tier separately, with moving parts permanently lubricated and metal parts cushioned to prevent metal-to-metal contact during operation.
1. Design so that each row carriage so that it will individually support the design loads and is self supporting when fully assembled without dependence on platform panels or boards, seats, or fascia.
2. Welding: In accordance with AWS D1.1/D1.1M and AWS D1.3/D1.3M.
3. Bolting: Use lock-washers or locknuts.
4. Wheels: Minimum 5 inch (125 mm) diameter by 1-1/8 inch (28 mm) wide, with non-marring rubber tires; ball, roller, or oil-impregnated metal bearings; minimum of 2 wheels at each floor support.
5. Finish: Manufacturer's standard enamel or powder coating.
6. Row Locking: Automatically mechanically lock each carriage to adjacent carriages when fully extended.
7. Unlocking (Manual): Provide single manual release mechanism to allow retraction of all carriages, concealed behind skirt board of first row.
8. Unlocking: Automatically unlock all rows before engaging retraction mechanism.

G. Motor Operation: Manufacturer's standard drive mechanism, using motor adequately sized for the purpose.
1. Provide UL listed electrical components and wiring.
2. Controls: Start, Stop, Forward, and Reverse in a single control unit.
3. Control Station: Removable plug-in low-voltage pendant station, with first-row plug-in location for each motor.
4. Control Station: Key-operated wall station.
5. Limit Switches: Automatically stop operation when unit has reached fully open or fully closed position.
6. Provide all wiring internal to bleacher units, to junction box located where indicated; ensure that wiring is not energized except during operation.

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7. Electrical Characteristics: 120V, single phase, 60 Hz.
8. Provide access to motor from front side of bleachers; a hinged front skirt or hinged section at least 30 inches (760 mm) wide is acceptable.

2.3 SEAT AND PLATFORM COMPONENTS

A. Seat/Fascia Assembly: Continuous, molded UV-stabilized high-density polyethylene plastic, seat minimum 1 inch (25 mm) thick, textured finish, homogeneous color throughout, color as selected from manufacturer's standard selection; approximately 18 inch (460 mm) long sections independently removable with tongue-and-groove or rabbeted interlock at end joints.
   1. Shape: Ergonomically contoured, with internal ribs spaced for natural flexibility; rear edge cantilevered to provide toe room of not less than 3 inches (75 mm); no openings to trap debris.
   2. Fire Retardance: Self-ignition temperature of 650 degrees F (343 degrees C) or greater when tested in accordance with ASTM D1929; smoke developed index of 450 or less, when tested in accordance with ASTM E84, or 75 or less when tested in thickness intended for use in accordance with ASTM D2843; and burning extent of 1 inch (25 mm) or less when tested in thickness intended for use in accordance with ASTM D635.
   3. Provide end caps of same material and finish on each exposed end.
   4. Supports: Internal steel reinforcement of each seat segment bolted to platform nose member; minimum two bolts per segment.
   5. Seat and Row Numbers: Provide recessed pockets for number plates by others.

B. Platform, Tread, and Step Structure: Extruded aluminum, with ribbed surface, with joint sleeve assembly to maintain alignment at end-to-end junctions.
   1. Extrusions: Minimum 5/8 inch (16 mm) deep with minimum 0.09 inch (2 mm) wall thickness
   2. Finish: Mill finish.
   3. Nosings: Matching aluminum extrusion.
   4. Front, Rear, and Intermediate Supports: Aluminum or steel channel or tube, hot-dipped galvanized.
   5. Provide end caps of same material and finish on each exposed end.
   6. At aisles provide permanently attached intermediate steps of same construction and finish.
   7. At bottom of aisles provide step in front of first riser, hinged to first platform to fold for storage.

2.4 HANDRAILS AND RAILINGS

A. Provide the following railings:
   1. Aisle Handrails: Single post folding railing segment mounted in center of aisle at every other row beginning at row 2.
   2. End of Row Guardrails: Self-storing, at open ends of sections beginning at row 2.
   3. Top Row Rear Guardrail: Non-removable self-storing, mounted behind rear seat with tubular supports, running full width of section.
   4. Height: 42 inches (1067 mm) above adjacent platform or tread.
   5. Removable Railings: Provide steel post sockets attached to platform supports.

B. Design handrails and railings to withstand the following loads:
   1. Concentrated Load on Handrails: 200 pounds (890 N) in any direction.
   2. Concentrated Load on Guardrails: 200 pounds (890 N) in any direction along top rail.
   3. Live Load on Handrails: 50 pounds per linear foot (790 N/m), applied in any direction.
   4. Live Load on Guardrails:
      a. Horizontal: 50 pounds per linear foot (790 N/m), applied at the guardrail height.
      b. Vertical: 100 pounds per linear foot (1460 N/m), applied vertically to top of guardrail.

C. Railing Construction: Round steel or aluminum pipe or tube, with formed elbows at corners and caps at ends of straight runs.
   1. Steel: 1-1/2 inch (38 mm) minimum outside diameter, with 11 gauge, 0.12 inch (3.05 mm) minimum wall thickness; textured powder coat epoxy finish.
   2. Guardrail Infill: 9 gauge, 0.1144 inch diameter (2.91 mm diameter) steel wire woven chain link with twisted selvages, fastened to pipe panel frame.

2.5 ACCESSORIES

A. Fillers and Closures:
   1. Ends of Retracted Units: Plywood panels, finished to match platforms.
   2. Top Row: Provide seat level rear filler panels to close openings between top row seat and wall; finish to match platforms.
   3. Back of Units: Full width plywood panels, finished to match platforms, up to 8 feet (2.44 m) above floor; vinyl curtains above to underside of top platform.

B. Fasteners: Provide hardware and fasteners in accordance with manufacturer's recommendations.

C. Anchorage: As indicated on drawings; provide hardware in accordance with manufacturer's recommendations.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are consistent with those on the shop drawings.

B. Verify that electrical rough-ins have been installed and are accessible.

C. Do not begin installation until substrates have been properly prepared and area has been cleared of obstructions.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Do not field cut or alter seats, fascia, or structural members without approval.

C. Provide manufacturer's field representative to inspect completed installation.

3.4 ADJUSTING

A. Lubricate, test, and adjust each moving assembly to ensure proper operation in compliance with manufacturer's recommendations.

3.5 CLEANING

A. Clean exposed and semi-exposed assembly surfaces.

B. Touch up finishes on damaged or soiled areas.

3.6 CLOSEOUT ACTIVITIES

A. Demonstration and Training: Provide manufacturer's field representative to demonstrate to and train Owner's operating personnel in proper operation of equipment.
   1. Location: On site using installed equipment.
   2. Time: As agreed between Owner and Construction Manager.

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3.7 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair, or replace damaged products before Date of Substantial Completion.

END OF SECTION

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SECTION 12 93 13 - BICYCLE RACKS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Metal bicycle double sided racks and attachments to concrete slab.

1.3 REFERENCE STANDARDS

A. ASTM A314 – 13a: Standard Specification for Stainless Steel Billets and Bars for Forging.

B. ASTM A 513/513M-14: Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing.

C. ASTM A 500/500M-13: Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Tubing in Rounds and Shapes.

D. ASTM A879/879M-12: Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements, for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 - Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 - Product Requirements for substitution procedures.

C. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

D. Shop Drawings: Show assembly and installation details. Include physical characteristics such as shape, dimensions, bicycle parking capacity and finish.

E. Samples:
   1. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
   2. Verification Samples: For each finish product specified, two samples, minimum size 2” (52mm) square, representing actual product, color, and patterns.

F. Maintenance Data: Include recommended methods for repairing damage to the powder coat finish.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firm shall have five continuous years experience in manufacturing site furnishing products similar to those specified and record of successful in-service performance.

B. Installer Qualifications: Installer shall be certified by manufacturer and experienced installer who has completed installation of bicycle racks similar in material, design, and extent to that indicated, and whose work has resulted in construction with record of successful in-service performance.

C. Source Limitations: Obtain each color, finish, and type of bicycle locker from single source with resources to provide components of consistent quality in appearance and physical properties.

D. Product Options: Drawings indicate size, shape and dimensional requirements of bicycle lockers and are based on the specific system indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the site in undamaged condition. Carefully store materials to provide protection against damage from moisture, heat, cold, direct sunlight, or other causes.

B. Store products in manufacturer's unopened packaging until ready for installation.

C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.8 PROJECT CONDITIONS

A. Anticipate environmental conditions (temperature, humidity, and ventilation) to schedule work within limits recommended by manufacturer for optimum results.

B. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.9 WARRANTY

A. Provide manufacturer's limited one (1) year warranty.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer(s) and basis of design for products shall be as indicated. However, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product, and they comply with Section 01 60 00.0 requirements regarding substitutions to be considered, including acceptance is provided by the Architect in writing prior to bidding.
   1. Madrix Bicycle Security: www.madrax.com
      a. Basis of Design Product: "Heavy Duty Winder"
   2. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
      a. Dura Bike Locker Co., 4019 Leos Lane Unit 3; Carmichael, CA 95608; Toll Free Tel: 800-722-2453; Tel: 916-488-7026: www.duralocker.com.
         1) Basis of Design Product: "Gridrac"
      b. Saris Cycling Group, 5253 Verona Rd., Madison, WI 53711; Tel: 800-783-7257, 608-274-6550: www.sarisparking.com.
         1) Basis of Design Product: "6200 Series Commercial Duty Park-A-Ride"

2.2 BICYCLE RACKS

A. Capacity: Match existing capacity.

B. Design and Construction:
   1. Galvanized steel finish with anti-graffiti powder coating.
   2. 100% UV rating.

C. Provide number of units indicated on Drawings.

D. Color: As selected by Architect from Manufacturer’s full range of standard colors.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until location has been properly prepared.

B. If location preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean location thoroughly prior to installation.

B. Prepare surfaces using methods recommended by manufacturer for achieving best result under project conditions.

3.3 INSTALLATION

A. Install in accord with manufacturer's written instructions.

B. Locate where indicated. Assemble and anchor in accord with manufacturer's instructions.

C. Set bicycle racks secured to concrete, level and true to line, perpendicular and parallel with concrete pad.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

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SECTION 14 24 00 - HYDRAULIC ELEVATORS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References, are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, materials, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Complete hydraulic elevator systems.
      a. Passenger type.
   2. Elevator Maintenance Contract.

1.3 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. AISC 360 - Specification for Structural Steel Buildings; 2022, with Errata (2025).

C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

D. ASME A17.1 - Safety Code for Elevators and Escalators Includes Requirements for Elevators, Escalators, Dumbwaiters, Moving Walks, Material Lifts, and Dumbwaiters with Automatic Transfer Devices; 2022.

E. ASME A17.2 - Guide for Inspection of Elevators, Escalators, and Moving Walks Includes Inspection Procedures for Electric Traction and Winding Drum Elevators, Hydraulic Elevators, Inclined Elevators, Limited-Use/Limited-Application Elevators, Private Residence Elevators, Escalators, Moving Walks, Dumbwaiters, and Material Lifts; 2023.

F. ASME QEI-1 - Standard for the Qualification of Elevator Inspectors; 2024.

G. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

H. ASTM A139/A139M - Standard Specification for Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over); 2022.

I. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2025.

J. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

K. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

L. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.

M. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

N. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

O. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

P. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021, with Errata (2023).

Q. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025, with Errata (2026).

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R. ITS (DIR) - Directory of Listed Products; Current Edition.

S. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

T. NEMA MG 00001 - Motors and Generators; 2024.

U. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

V. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

W. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2025.

X. UL (DIR) - Online Certifications Directory; Current Edition.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements, for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Refer to Section 01 30 00.0 - Administrative Requirements for submittal procedures.

B. Refer to Section 01 60 00.0 – Product Requirements for substitution procedures.

C. Product Data: Submit data on following items:
   1. Signal and operating fixtures, operating panels, and indicators.
   2. Car design, dimensions, layout, and components.
   3. Car and hoistway door and frame details.
   4. Electrical characteristics and connection requirements.

D. Shop Drawings: Include appropriate plans, elevations, sections, diagrams, and details on following items:
   1. Elevator Equipment and Machines: Size and location of driving machines, power units, controllers, governors, and other components.
   2. Hoistway Components: Size and location of car guide rails, buffers, jack unit and other components.
   3. Rail bracket spacing; maximum loads imposed on guide rails requiring load transfer to building structural framing.
   4. Individual weight of principal components; load reaction at points of support.
   5. Clearances and over-travel of car.
   6. Locations in hoistway and machine room of traveling cables and connections for car lighting and telephone.
   7. Location and sizes of hoistway and car doors and frames.
   8. Calculated heat dissipation of elevator equipment in machine room.
   9. Applicable seismic design data; certified by a licensed Professional Structural Engineer.
   10. Interface with building security system.
   11. Electrical characteristics and connection requirements.
   12. Indicate arrangement of elevator equipment and allow for clear passage of equipment through access openings.

E. Samples: Submit samples illustrating car interior finishes, car and hoistway door and frame finishes, and handrail material and finish in the form of cut sheets and finish color selection brochures.

F. Designer's Qualification Statement.

G. Manufacturer's Qualification Statement.

H. Installer's Qualification Statement.

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I. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

J. Testing Agency's Qualification Statement.

K. Initial Maintenance Contract.

L. Maintenance Contract: Submit proposal to Owner for standard one year continuing maintenance contract agreement in accordance with ASME A17.1 and requirements as indicated, starting on date initial maintenance contract is scheduled to expire.
   1. Indicate in proposal the services, obligations, conditions, and terms for agreement period and for renewal options.
   2. Use form, Draft of Elevator Maintenance Agreement, provided after this section.

M. Operation and Maintenance Data:
   1. Parts catalog with complete list of equipment replacement parts; identify each entry with equipment description and identifying code.
   2. Operation and maintenance manual.
   3. Schematic drawings of equipment and hydraulic piping, and wiring diagrams of installed electrical equipment with list of corresponding symbols to identify markings on machine room and hoistway apparatus.

N. Specimen warranty.

O. Executed warranty.

1.6 QUALITY ASSURANCE

A. Designer Qualifications: Design guide rails, brackets, anchors, and machine anchors under direct supervision of a licensed Professional Structural Engineer experienced in design of this type of work and licensed in Florida.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years documented experience.

C. Installer Qualifications: Trained personnel and supervisor on staff of elevator equipment manufacturer.

D. Installer Qualifications: Company specializing in performing the work of this section and approved by elevator equipment manufacturer.

E. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and no more than 12 months before start of scheduled welding work.

F. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of type specified in this section.

G. Products Requiring Fire Resistance Rating: Listed and classified by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction.

H. Products Requiring Electrical Connection: Listed and classified by UL (DIR) or testing agency acceptable to authorities having jurisdiction as suitable for the purpose indicated in construction documents.

I. Documents at Project Site: Maintain at project site one copy of manufacturer's instructions, erection drawings, and shop drawings.

1.7 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with ASME A17.1, applicable local codes, and authorities having jurisdiction (AHJ).

B. Accessibility Requirements: Comply with ADA Standards.

C. Perform structural steel design, fabrication, and installation in accordance with AISC 360.

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D. Comply with seismic design requirements in accordance with ASME A17.1, applicable local codes, and authorities having jurisdiction (AHJ).
   1. Complying with Elevator Safety Requirements for Seismic Risk Zone in accordance with ASME A17.1, ASCE 7 and other related requirements.
      a. Project Seismic Risk: As indicated on drawings.
   2. Provide earthquake emergency operations in accordance with ASME A17.1 requirements.

E. Perform welding of steel in accordance with AWS D1.1/D1.1M.

F. Fabricate and install door and frame assemblies in accordance with NFPA 80 and in compliance with requirements of authorities having jurisdiction.

G. Perform electrical work in accordance with NFPA 70.

H. Comply with venting or pressurization of hoistway design in accordance with HVAC system requirements and authorities having jurisdiction (AHJ).

I. Comply with fire protection sprinkler system of hoistway design in accordance with NFPA 13 requirements and authorities having jurisdiction (AHJ).

1.8 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate work with other installers to provide conduits necessary for installation of wiring including but not limited to:
      a. Elevator equipment devices remote from elevator machine room or hoistway.
      b. Telephone service for machine room.
      c. Elevator pit for lighting and sump pump.
      d. Automatic transfer switch from controller cabinet.
      e. Fire alarm panel from controller cabinet.
   2. Coordinate work with other installers for equipment provisions necessary for proper elevator operation, including but not limited to, the following:
      a. Automatic transfer switches with auxiliary contacts for emergency power transfer status indication.
      b. Shunt trip devices for automatic disconnection of elevator power prior to fire suppression system activation.
      c. Overcurrent protection devices selected to achieve required selective coordination.

B. Preinstallation Meeting: Convene meeting at least one week prior to start of this work.
   1. Review schedule of installation, proper procedures and conditions, and coordination with related work.
   2. Review use of elevator for construction purposes, hours of use, scheduling of use, cleanliness of car, employment of operator, and maintenance of system.

C. Construction Use of Elevator: Not permitted.

1.9 WARRANTY

A. Manufacturer Warranty: Provide 1-year manufacturer warranty for elevator operating equipment and devices. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer and basis of design shall be the following. However, products of other manufacturers will be considered for acceptance, provided they equal or exceed the material requirements and functional qualities of the specified product, and acceptance is provided by the Architect in writing prior to bidding.
   1. TK Elevator (ThyssenKrupp): www.tkelevator.com/us-en

B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
   1. Otis Elevator Company: www.otis.com
   2. Schindler Elevator Corporation: www.schindler.com

C. Substitutions: See Section 01 60 00.0 - Product Requirements.

D. Source Limitations: Provide elevator and associated equipment and components produced by the same manufacturer as the other elevator equipment used for this project and obtained from a single supplier.

2.2 HYDRAULIC ELEVATORS

A. Hydraulic Passenger Elevator:
   1. Basis of Design Product: "endura"
   2. Hydraulic Elevator Equipment:
      a. Hydraulic with cylinder in buried casing below elevator pit.
   3. Electrical Power: 200-480 volts; alternating current (AC); three phase; 60 Hz.
   4. Rated Net Capacity: 3500 pounds (1590 kgs).
   5. Rated Speed: 80 feet per minute (FPM).
   6. Hoistway Size: As indicated on drawings.
   7. Interior Car Platform Size: 6'-3" by 7'-0".
   8. Elevator Pit Depth: 48 inch (1219 mm).
   9. Overhead Clearance at Top Floor: 12 ft.-5 in. minimum clearance, with top overtravel of 6 inches.
   10. Travel Distance: 14 feet.
   11. Number of Stops: Two (2).
   12. Platform Thickness: 3 3/8 inches.
   13. Bottom Car Runby: 6 inches.
   14. Distance between elevator pit floor and car bolster on compressed buffer: 2 ft. - 3 7/8 in.

2.3 COMPONENTS

A. Elevator Equipment:
   1. Motors, Hydraulic Equipment, Controllers, Controls, Buttons, Wiring, Devices, and Indicators: Comply with NFPA 70.
      a. See Division 26 specifications for additional information.
   2. Guide Rails, Cables, Buffers, Attachment Brackets and Anchors: Design criteria for components includes safety factors in accordance with applicable requirements of Elevator Code, ASME A17.1.
   3. Buffers:
      a. Spring type for elevators with speed less than or equal to 200 fpm (1 m/sec).
      b. Oil type for elevators with speed greater than 200 fpm (1 m/sec).
   4. Lubrication Equipment:
      a. Provide grease fittings for periodic lubrication of bearings.
      b. Grease Cups: Automatic feed type.
      c. Lubrication Points: Visible and easily accessible.

B. Electrical Equipment:
   1. Motors: NEMA MG 1.
   2. Boxes, Conduit, Wiring, and Devices: As required by NFPA 70.
      a. See Division 26 specifications for additional information.
   3. Sump Pump in Pit:
      a. See Division 22 specifications for additional information.
   4. Spare Conductors: Provide ten percent in extra conductors and two pairs of shielded audio cables in traveling cables.

5. Include wiring and connections to elevator devices remote from hoistway and between elevator machine room. Provide additional components and wiring to suit machine room layout.

C. Jack Type:
1. Below-ground, Conventional.
2. Jack hole depth: Travel length + 6 feet.

2.4 OPERATION CONTROLS

A. Door Operator Type: Universal Door Operator.

B. Controller Basis of Design Product: "TAC32" as manufactured by TK Elevator, solid state/microprocessor elevator controller for hydraulic elevators.

C. Manual Lowering: Manufacturer's standard.

D. Elevator Controls: Provide landing operating panels and landing indicator panels.
1. Landing Operating Panels: Metallic type, one for originating "Up" and one for originating "Down" calls, one button only at terminating landings; with illuminating indicators.
2. Landing Indicator Panels: Illuminating.
3. Comply with ADA Standards for elevator controls.

E. Interconnect elevator control system with building security, fire alarm, card access, smoke alarm, and building management control systems.

F. Door Operation Controls:
1. Program door control to open doors automatically when car arrives at floor landing.
2. Render "Door Close" button inoperative when car is standing at dispatch landing with doors open.
3. Door Safety Devices: Moveable, retractable safety edges, quiet in operation; equipped with photo-electric light rays.

G. Provide "Firefighter's Emergency Operation" in accordance with ASME A17.1, applicable building codes, and authorities having jurisdiction (AHJ).
1. Designated Landing: As selected by Architect.

2.5 OPERATION CONTROL TYPE

A. Swipe Card System:
1. Provide District's electronic security swipe card system.
2. Provide vandal-resistant push-button switches at cab interior.
3. Provide a vandal-proof emergency line-powered speakerphone inside the cab to comply with applicable codes and standards.
4. Fire call key switch.
5. Emergency phone.
6. Corridor push-button switches are not permitted.

2.6 EMERGENCY POWER

A. Set-up elevator operation to run with building emergency power supply when the normal building power supply fails, and in compliance with ASME A17.1 requirements.

B. Building Emergency Power Supply: Supplied by backup generator; provide elevator system components as required for emergency power characteristics with phase rotation the same as for normal power.
1. Provide transfer switches and auxiliary contacts.
2. Install connections to power feeders.

C. Elevator Emergency Power Supply: Supplied by battery backup; provide elevator system components as required for emergency power characteristics.

D. Emergency Lighting: Comply with ASME A17.1 elevator lighting requirements.

E. Provide operational control circuitry for adapting the change from normal to emergency power.

F. Upon transfer to emergency power, advance elevator to a pre-selected landing, stop car, open door, disable operating circuits, and hold in standby condition.

G. Elevator alarm bell: Provide 6-inch radius elevator alarm bell with weatherproof mounting at building exterior with an "Elevator Emergency" sign. Connect the bell to emergency power.

2.7 MATERIALS

A. Steel Cylinder Casing: ASTM A139/A139M, Grade A steel.

B. Rolled Steel Sections, Shapes, Rods: ASTM A36/A36M.

C. Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel), with matte finish.

D. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

E. Stainless Steel Sheet: ASTM A666/A666M, Type 304; No. 4 Brushed finish unless otherwise indicated.

F. Stainless Steel Bars, Shapes and Moldings: ASTM A276/A276M, Type 304.

G. Extruded Aluminum: ASTM B221 (ASTM B221M), natural anodized finish unless otherwise indicated.

H. Aluminum Sheet: ASTM B209/B209M, 3105 alloy, O temper.

I. Resilient Flooring and Base.

J. Plastic Laminate: NEMA LD 3.

2.8 CAR AND HOISTWAY ENTRANCES

A. Hoistway, General:
   1. Provide hoistway barricade and all cutting and patching to install hoistway entrance, sills, hall fixtures, oil and electric lines.
   2. Provide plumb, properly ventilated hoistway per code.
      a. A properly vented hoistway and maintained between 32°F (0°C) and 104°F (40°C) with non-condensing humidity of 10-95%.
   3. Provide adequate support for jack, guide rail brackets, and buffers.
   4. Provide smoke sensors as required.
   5. Provide conduit and wiring from hoistway to elevator monitoring panels (for security, life, safety, or fire requirements).
   6. Provide pockets in wall for hall fixtures. Pockets in wall must be located as directed by elevator contractor.
   7. Leave off entire front wall at all floors where entrance is included. See manufacturer's installation procedures for frame-to-wall interface details to ensure conformance with labeled entrance interface construction. At controller floor, leave out entire wall.

B. Elevator, No. 1:
   1. Car and Hoistway Entrance:
      a. Hoistway Fire Rating: 1 Hour.
      b. Elevator Door Fire Rating: 1 Hour.
      c. Framed Opening Finish and Material: Alkyd enamel on steel.
      d. Car Door Material: Stainless steel, with rigid sandwich panel construction.
      e. Hoistway Door Material: Stainless steel, with rigid sandwich panel construction.
      f. Interior Car Height:
         1) Minimum Rough Opening: 8 ft.-3 in..
         2) Ceiling Canopy Height: 7 ft.-4 in..
      g. Door Type: Single leaf.
      h. Number of Openings: One (1) Front.
      i. Door Operation Type: One-speed, Left-Hand opening.

j. Door Width: 42 inches (1.067 m).
k. Door Height: 84 inches (2.134 m).
l. Sills: Extruded aluminum.

C. Sills/Thresholds: Configure to align with frame return and coordinate with floor finish.

D. Gasketing: Provide acoustic type gasketing at hoistway doors and frames to eliminate audible noise due to car activities in the hoistway, and air pressure differential between hoistway and landing floors.

2.9 CAR EQUIPMENT AND MATERIALS

A. Elevator Car, No. 1:
1. Comply with FAC for cab size and mounting height of controls.
2. Elevator pits:
a. Provide a dry area and include the following:
1) Sump pit with a metal cover with moisture detection system.
2) Provide elevator pit lights and switch, convenience outlets with GFCI protection per NEC.
(a) Two moisture-proof light fixtures per pit.
(b) One grounded duplex receptacle.
3) Provide pit ladder, clear of all elevator equipment.
(a) Metal ladder, if pit is deeper than 3'-0".
4) PVC or plastic pipes not permitted.
3. Provide dedicated 120 volt, 15 amp. service, along with telephone circuit when required, to terminals of each required controller for the following:
a. Car light and alarm circuit with GFCI protection per NEC.
b. If standby power is supplied to elevator, car light and alarm circuit service must be standby power backed.
4. Hand Rail: Stainless steel, at all three sides. Provide open clearance space 1-1/2 inch (38 mm) wide to face of wall.
a. Round, Metal Tube: 1-1/2 inch (38 mm) diameter.
b. Stainless Steel Finish: No. 4 Brushed.
5. Wall Finish:
a. Manufacturer and basis of design shall be the following. However, products of other manufacturers will be considered for acceptance, provided they equal or exceed the material requirements and functional qualities of the specified product, and acceptance is provided by the Architect in writing prior to bidding.
1) Formica® Laminate - Commercial: www.formica.com/en-us
2) Substitutions: See Section 01 60 00.0 - Product Requirements.
(a) Basis of Design Product: "Matte 58"
6. Floor Finish:
a. Finish material and color to match new interior stair floor finish.
7. Ceiling:
a. Canopy Ceiling: White translucent diffusers with ceiling frames.
b. Exposed Frame Suspended Ceiling with 1-1/2 inch (38 mm) nominal space between edge of ceiling and wall.
c. Frame Finish: Aluminum, brushed finish.
d. Lay-in Panel: Translucent, polycarbonate panels.
e. Lighting: Compact fluorescent downlights.
f. Provide emergency access panel for egress from car at ceiling.

B. Car Accessories:
1. Certificate Frame: Stainless steel frame glazed with tempered glass, and attached with tamper-proof screws.

2. Braille plates:
    a. Resin braille plate.

2.10 MACHINE ROOM FITTINGS

A. Wall-Mounted Frames: Glazed with clear plastic; sized as required. Provide one chart each for master electric and hydraulic schematic and for lubrication chart. Install charts.

B. Key Cabinet: Wall-mounted, lockable, keyed to building keying system, for control and operating panel keys.
    1. Provide two key cabinet keys.
    2. Provide two control/operating panel keys.
    3. Provide two card access keys.

C. Monitoring Device Interface:
    1. Fabricate one multiple terminal block in controller relay panel or selector, in location indicated, for connection of monitoring devices for:
        a. Landing and car registration circuits.
        b. Motor generator running circuits.
        c. Load weighing circuits.
        d. Up and down peak programming circuits.
        e. Independent service switches.
    2. Label terminals for use with alligator test clips.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting this work.

B. Verify that hoistway and pit are ready for work of this section.

C. Verify hoistway shaft and openings are of correct size and within tolerance.

D. Verify that electrical power is available and of correct characteristics.

3.2 PREPARATION

A. Arrange for temporary electrical power for installation work and testing of elevator components.

B. Excavate for in-ground hydraulic cylinder casing and remove subsoil from site.

C. Maintain in-ground shaft alignment of 1/2 inch (12.7 mm) maximum from plumb.
    1. Fill over-excavated shaft depth with lean concrete.

D. Maintain elevator pit excavation free of water.

E. Maintain in-ground elevator shaft excavation free of water.

F. Place in-ground plunger casing full depth of shaft. Align to 1/4 inch (6.4 mm) from plumb. Cut top of casing at hoistway pit slab elevation.

G. Backfill around in-ground cylinder casing.

3.3 INSTALLATION

A. Coordinate this work with installation of hoistway wall construction.

B. Install system components, and connect equipment to building utilities.

C. Provide conduit, electrical boxes, wiring, and accessories; See Division 26 for additional information.

D. Install hydraulic piping between cylinder and pump unit.

E. Mount motors and pumps on vibration and acoustic isolators.
    1. Place on structural supports and bearing plates.
    2. Securely fasten to building supports.

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3. Prevent lateral displacement.

F. Install hoistway, elevator equipment, and components in accordance with approved shop drawings.

G. Install guide rails to allow for thermal expansion and contraction movement of guide rails.

H. Accurately machine and align guide rails, forming smooth joints with machined splice plates.

I. Bolt or weld brackets directly to structural steel hoistway framing.

J. Field Welds: Chip and clean away oxidation and residue with wire brush; spot prime surface with two coats.

K. Install hoistway door sills, frames, and headers in hoistway walls; grout sills in place, set hoistway floor entrances in alignment with car openings, and align plumb with hoistway.

L. Fill hoistway door frames solid with grout.

M. Structural Metal Surfaces: Clean surfaces of rust, oil or grease; wipe clean with solvent; prime two coats.

N. Machine Room Components: Clean and degrease; prime one coat, finish with one coat of enamel.

O. Adjust equipment for smooth and quiet operation.

3.4 TOLERANCES

A. Guide Rail Alignment: Plumb and parallel to each other in accordance with ASME A17.1 and ASME A17.2.

B. Car Movement on Aligned Guide Rails: Smooth movement, without any objectionable lateral or oscillating movement or vibration.

3.5 FIELD QUALITY CONTROL

A. Testing and inspection performed at discretion of regulatory agencies certified in accordance with ASME QEI 1.
   1. Schedule tests with agencies and notify Owner and Architect.
   2. Obtain permits as required to perform tests.
   3. Document regulatory agency tests and inspections in accordance with requirements.
   4. Perform tests required by regulatory agencies.
   5. Furnish test and approval certificates issued by authorities having jurisdiction.

B. Perform testing and inspection in accordance with requirements.
   1. Inspectors shall be certified in accordance with ASME QEI-1.
   2. Perform tests as required by ASME A17.2.
   3. Provide at least two weeks written notice of date and time of tests and inspections.
   4. Supply instruments and execute specific tests.

C. Operational Tests:
   1. Perform operational tests in the presence of Owner and Architect.
   2. At an agreed time, and the building occupied with normal building traffic, conduct tests to verify performance.
      a. Furnish event recording of each landing call registrations, time initiated, and response time throughout entire working day.

3.6 ADJUSTING

A. Adjust for smooth acceleration and deceleration of car to minimize passenger discomfort.

B. Adjust with automatic floor leveling feature at each floor landing to reach 1/4 inch (6.4 mm) maximum from flush with sill.

3.7 CLEANING

A. Remove protective coverings from finished surfaces.

B. Clean surfaces and components in accordance with manufacturers written instructions.

3.8 CLOSEOUT ACTIVITIES

A. Demonstrate proper operation of equipment to Owner's designated representative.

B. Demonstration: Demonstrate operation of system to Owner's personnel.
   1. Use operation and maintenance data as reference during demonstration.
   2. Conduct walking tour of project.
   3. Briefly describe function, operation, cleaning and maintenance of each component.

C. Training: Train Owner's personnel on cleaning and operation and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours of training.
   3. Instructor: Manufacturer's training personnel.
   4. Location: At project site, unless noted otherwise.

3.9 PROTECTION

A. Do not permit construction traffic within car after cleaning.

B. Protect installed products until Date of Substantial Completion.

C. Touch-up, repair, or replace damaged products and materials prior to Date of Substantial Completion.

3.10 MAINTENANCE

A. Provide Initial Maintenance Contract of elevator system and components in accordance with ASME A17.1 and requirements as indicated for 3 months from Date of Substantial Completion.

B. Submit proposal for continuation of Maintenance Contract in accordance with ASME A17.1 and requirements as indicated for installed elevator equipment.

C. Perform maintenance contract services using competent and qualified personnel under the supervision and direct employ of the elevator manufacturer or original installer.

D. Maintenance contract services shall not be assigned or transferred to any agent or other entity without prior written consent of Owner.

E. Examine system components periodically.

F. Include systematic examination, adjustment, and lubrication of elevator equipment.

G. Maintain and repair or replace parts, whenever required, using parts produced by original equipment manufacturer.

H. Perform work without removing car from use during peak traffic periods.

I. Provide emergency call back service during regular working hours throughout period of this maintenance contract.

J. Maintain an adequate stock of parts for replacement or emergency purposes, and have personnel available to ensure the fulfillment of this maintenance contract without unreasonable loss of time.

END OF SECTION

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SECTION 21 00 02 - FIRE SUPPRESSION SYSTEMS - PERFORMANCE BASED

PART 1 - GENERAL

1.1 SYSTEM DESCRIPTION

A. Layout and provide automatic wet pipe fire sprinkler system in accordance with but not limited to NFPA 101, NFPA 13, local and county codes and all applicable codes set forth by the Authority Having Jurisdiction. Discharge from individual heads in the hydraulically most remote/demanding areas shall be hydraulically calculated to an acceptable margin of safety not less than 10 psi for growth and fluctuation in the available water supply of the area. Each system shall include materials, accessories, and equipment inside and outside the building to provide each system that is complete and ready for use. Design and provide each system to give full consideration to blind spaces, piping, electrical equipment, ducts, HVAC equipment, access space needed for maintenance of equipment and other construction and equipment in accordance with detailed working drawings to be submitted for approval. Locate sprinkler heads in a consistent pattern with ceiling grid, lights, diffuser, registers, and grilles. Provide sprinkler heads and piping system layout. Devices and equipment for fire protection services shall be U.L. listed or F.M. approved for use in wet pipe system.

1.2 QUALITY ASSURANCE

A. Qualification of installers.

1. The entire fire protection system shall be fabricated, installed, and tested by a company approved by owner. Contractor shall qualify himself as to experience, insurability, and capability by submitting an “AIA” and a 306 contractor’s qualification statement. Satisfactory completion of similar projects is required.

B. All fire protection systems and equipment shall conform to the applicable standards and requirements of the following:

1. Sprinkler systems: NFPA 13, 2019
2. Florida Administrative code 61G15-32.003 and 61G15-32.004.
3. Florida Building Code, 8th Edition 2023
4. Life Safety Code - NFPA 101, 2021
5. Florida Fire Prevention Code, 2023
6. Local codes or standards incorporated by the authority having jurisdiction.
7. All components shall be U.L. listed and FM (Factory Mutual) approved and labeled where applicable.
8. Installation of sprinkler system components shall be per the more stringent or either U.L. listed or FM (Factory Mutual) approved installation requirements.
9. The entire fire protection system shall be approved by the authority having jurisdiction. Any adjustments or additions to this system required to secure the approvals, shall be part of the work of this section.

1.3 SUBMITTALS

A. Working plans shall be submitted by a State of Florida license fire protection contractor.

B. Working plans shall be drawn on sheets of uniform size at a scale of not less than 1/8 inch - ft., with plan of each floor on reproducible material, and shall show thefollowing data:

1. Name of Owner and Occupant.
2. Location, including street address.
3. Point of compass.
4. Ceiling construction.

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5. Full height cross section.
6. Location of fire walls.
7. Location of partitions.
8. Occupancy of each area or room.
9. Location and size of concealed spaces and closets.
10. Any questionable small enclosures in which no sprinklers are to be installed.
11. Size of city main in street, pressure and whether dead-end or circulating and, if dead-end, direction and distance to nearest circulating main, city main test results.
12. Other sources of water supply, with pressure or elevation.
13. Make, type and nominal orifice size of sprinkler.
14. Temperature rating and location of high temperature sprinklers.
15. Total area protected by each system on each floor.
16. Number of sprinklers on each riser per floor.
17. Make, type, model and size of each valve.
18. Make, type, and location of each interior and exterior alarm as required by local Code.
19. Total number of sprinklers on each system.
20. Approximate capacity in gallons of each system.
21. Pipe type and schedule of wall thickness.
22. Nominal pipe size and cutting lengths of pipe.
23. Location and size of riser nipples.
24. Type of fittings and joints and location of all welds and bends.
25. Type and locations of hangers and sleeves.
26. All control valves, check valves, drainpipes, and test pipes.
27. Size and location of hand hose, hose outlets and related equipment.
28. Make, type, model, and size of all fire department connections.
29. Underground pipe size, length, location, weight, material, points of connection to city main; type of valves, meters, and valve pits; and the depth that the top of pipe is laid below finished grade.
30. Provisions for flushing.
31. Hydraulic data nameplate with name and address of contractor.
32. Cross connection protection devices as required by the local authority.
33. Drawings, cuts, and catalog information showing manufacturer name, product numbers, or other means of identification, of all pipe, fittings, valves, and other materials, dimensions, weight, performance, etc., of all equipment. All information shall be submitted on reproducible copies.
34. Schedules of all material showing manufacturer.
35. Drawings and details showing pumps, jockey pumps, controls, mains, risers, drains, runs, branches, valves, alarms, fire hose racks, etc., for complete fire protection system.
36. In addition to submittals to the authority having jurisdiction furnish to the Architect copies of working plans in quantities as designated in on 15010 for reviewand comment. Any adjustments to the installation or materials of the system required by the Architect as noted on the plans shall be part of the work of this section.

C. Approval of the complete system shall be obtained from the authorities having jurisdiction, and a copy of the same shall be delivered to the Owner'srepresentative for delivery to owner.

1.4 APPROVAL

A. The installer shall perform all required acceptance tests, complete the contractor's material, and test certificate and forward the certificates to the authority having jurisdiction prior to asking for approval of the installation.

B. The general contractor & the Owner's authorized representative shall schedule all inspections with the AHJ and the AHJ shall be given a 24 hour prior to any requested inspection.

C. When the authority having jurisdiction desires to be present during the conduct of acceptance tests, the installer shall give advance notification of the time and date the testing will be performed.

D. All acceptance tests shall be in strict compliance with NFPA 13, Chapter 16 'Acceptance Tests" including, but not limited to the following:

1. All piping and attached appurtenances subjected to system working pressure shall be hydrostatically tested at 200 psi (13.8 bar) and shall maintain that pressure without loss for 2 hours.
2. Contractor must fill out the "Contractor's Material and Test Certification for Aboveground Piping" and submit to the Building Department and Engineer, as stated in Figure 16.1 of NFPA Chapter 16.
3. Portions of systems normally subject to system working pressures in excess of 150 psi (10.4 bar) shall be tested as described in NFPA 13-16.2.2.1 at a pressure of 50 psi (3.5 bar) in excess of system working pressure.
4. Loss shall be determined by a drop in gauge pressure or visual leakage.
5. The test pressure shall be read from a gauge located at the low elevation point of the system or portion being tested.
6. Additives, corrosive chemicals such as sodium silicate, or derivates of sodium silicate, brine, or other chemicals shall not be used while hydrostatically testing systems or stopping leaks.
7. Provisions shall be made for the proper disposal of water used for flushing or testing.

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. Provide sprinkler heads of type indicated and to suit each location. Types noted on drawings.

B. Sprinkler heads in areas with ceilings shall be the pendent type, white finish with two- piece escutcheon plates. All other heads to be brass finish. Sprinkler head guards are to be installed in areas where heads are exposed to damage.

C. Sprinkler heads in areas with no ceiling (no tiles or gypsum board) shall be a brass upright sprinkler type. Sprinkler head guards shall be installed in areas where heads are exposed to damages.

D. Side wall heads mounted on a wall or soffit shall be provided with white finish.

E. Teflon pendent sprinklers shall be installed in areas prone to high moisture (showers, locker Rooms, etc.).

F. Corrosion resistant sprinklers shall be installed in areas prone to corrosion.

G. Pendent sprinklers shall be installed in all areas with lay-in ceilings. Sprinkler shall be located in the center of the tile.

H. Orifice size for all sprinkler heads shall be 1/2 inch unless conditions occur whichwill require another size. Sprinkler pipe hangers and supports shall be subject to applicable requirementsof NFPA 13.

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I. Provide a surface mounted cabinet at system riser location with spare heads of each type used and wrenches to fit heads in accordance with NFPA 13.

J. Provide a Siamese connection branded “AUTO. SPKR." with caps and chains, check valve and ball drip as directed by the local official for connection by the fire department.

K. Provide water motor gong.

L. Provide all appropriate signage to properly identify all fire protection system components.

M. All manufacturers’ instruction on installation, operation and maintenance shall be provided to owner upon completion of installation.

2.2 MATERIALS

A. Product Handling:

1. Protection: Use all means necessary to protect fire sprinkler system materials before, during and after installation and to protect the installed work of all other trades.

2. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

B. Steel Piping:

1. Pipe shall be new, designed for 175 psi working pressure, conforming to ASTM specifications and have the manufacturers name and brand, along with the applicable ASTM standard, marked on each length of pipe.

a. Overhead - Steel piping shall be black or galvanized steel.

i. Standard Wall: Overhead piping to be black steel, electric resistance welded and shall comply to the specifications of ASTM-135. Piping 2-1/2 inches and larger to be schedule 10 and 2 inches and smaller to be Schedule 40. All pipe and fittings to be in accordance with NFPA.

ii. Thin Wall: Overhead pipe sizes of 2-1/2 inches and larger for welded and seamless type specified in ASTM A 53-80 used in welded systems shall have a minimum pipe wall thickness for pressures up to 300 psi as follows: Schedule 10 in sizes up to 5 inch; 0.134 inches for 6 inch; and 0.188 inches for 8 inch pipe. Pipe ends shall be roll grooved or welded in accordance with NFPA 13.

b. Underground: Ductile iron pipe to be utilized under the building to a point 5’-0” outside the building line. All underground fittings to be mechanical joint per NFPA A24. Refer to civil specifications for site underground piping materials.

C. Fittings:

1. Changes in direction shall be accomplished by the use of fittings suitable for use in sprinkler systems and defined in NFPA 13. Bushings shall not be used unless written approval is obtained from the Engineer.

a. Steel Pipe Fittings:

i. Fittings shall withstand a cold-water working pressure of not less than 175 psi and shall be cast or malleable iron in compliance with the NFPA Standards. Victaulic fittings are equally acceptable.

ii. Fittings for pipe size 2 inches and under shall be screwed and for pipe sizes 2-1/2 inches and over may be grooved coupling or flanged to suit the NFPA requirements.

iii. Flanged fittings shall be cast iron, short body, Class 125, black and in accordance with ANSI B 16.1. Gaskets shall be full face on 1/8 inch minimum thickness red sheet rubber. Flange bolts shall be hexagon head nuts, cadmium plated, having dimensions in accordance with NSI B 18.2.

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iv. Weld fittings shall be steel, standard weights, black and in accordance with ANSI B 16.9, ANSI B 16.25, ANSI B16.11 and ASTM A 234.

v. Grooved couplings and mechanical fittings shall be malleable iron, 500 psi working pressure, in accordance with ASTM A 47. The couplings gasket material shall be butyl rubber. Grooved couplings and mechanical fittings shall be tested and listed by UL and/or FM and products of the same manufacturer.

vi. Push-on fittings shall not be used.

D. Shut-Off Valves:

1. Except as hereinafter specified, valves used on the system shall be 175 lbs. UL listed and approved by FM Insurance Group.
2. All control valves shall be butterfly type with grooved or wafer body. Valve shall be of the indicator type and UL/FM approved. Central Mode BFV or equal.
3. Check valves shall be UL and FM approved swing check type for 175 psi pressure, as manufactured by Crane, Jenkins, or Victaulic.
4. Valves, where noted, shall be supervised type. Supervisory switches at the valve shall be manufactured by Potter Electric Signal & Mfg., Co. Ltd. Model OSTS-B or PTS to suit valve size with two (2) sets of form 'C' contacts for remote monitoring switches shall be UL and FM approved.
5. Wiring from the supervised valve up to and including the supervisory annunciator will be done under the Electrical Division 26.

E. Riser Check Valves and Flow Indicators:

1. Riser check valve assemblies shall be provided complete with gate valves, test connections, pressure gauges and flow switches.
2. Provide flow indicators where shown and as manufactured by Grinnell Co., or Potter Electric.
3. Flow switches shall be provided with two 2 sets of form 'C' (SPDT) contacts.
4. Alarm check valves and flow indicators will be connected to the fire alarm system under Electrical Division 26.
5. Riser check valves for wet system shall be manufactured by Automatic Sprinkler Company, Viking Sprinkler Company, Grinnell Company, Star Sprinkler Corporation and/or Reliable Automatic Sprinkler Company.

F. Drains for Test Connections: Provisions shall be made to run drain line from sprinkler test connection to the outside of the building.

G. Alarm Systems:

1. Provide one normally open and one normally closed 120-volt A.C., rated alarm contacts on the alarm valves.
2. Alarm contacts to the fire alarm annunciator will be connected under Electrical Division 26, including wiring, conduit, and annunciator.

H. Painting includes field painting of exposed pipes and fire system items (interior and exterior of the project), FD connections, fire hydrant, and hangars. Color to be: Red Tomato SW6607.

PART 3 - EXECUTION

3.1 SYSTEM DESIGN CONDITIONS

A. The sprinkler piping shall be hydraulically designed and shall be governed by NFPA 13, Chapter 7, Hydraulically Designed Sprinkler Systems.

B. Coordinate setting of equipment with the requirements of other trades so as to avoid conflicts and to insure compatibility. Equipment shall not block access for installation of other equipment.

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C. Set base mounted equipment on permanent and finished supports. Temporary support, if any, shall be removed prior to making final pipe connections to equipment.

D. Adjust suspended equipment to final elevation prior to making pipe connections.

E. Exercise caution during equipment placing operations to ensure that structure is not overloaded.

F. Installation of the fire protection systems shall be entrusted to none but fully experienced workers. The fire protection system shall be installed by responsible parties equipped to do the work under the approved detailed plans and specifications.

G. Provide sleeves and escutcheon plates at all pipe/wall penetrations.

H. All surfaces shall be protected during installation and testing of system.

I. During progress of work, maintain an accurate record of all changes made in the fire system installation from layout materials shown on the approved shop drawings.

PART 4 - TRAINING

4.1 TRAINING OF FACILITIES STAFF

A. The sprinkler contractor shall provide training in the time required for staff to fully understand the basic information of the sprinkler system and requirement to keep the sprinkler system certified.

B. The training shall be held on site for the familiarity of the system to the staff.

C. Contractor is responsible for providing handout to all staff to be trained and provide one electronic copy reproducible by the St. John's County School District.

D. Contactor shall provide a schedule for testing and maintenance to maintain a certified sprinkler system.

E. Contractor shall advise staff on recommended procedures in occurrence of an accidental sprinkler head discharge.

F. Testing schedule requirements per the Table below:

Training Schedule							
Div.	Training Description	Subcontractor	Dem Date	Time	Hours	Comments	Personnel to attend training
	Automatic Sprinkler System – Wet Pipe				2 hours	Demonstrate to owner selected personnel the operation of entire system, required maintenance and emergency procedures	

END OF SECTION

SECTION 22 00 01 - PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 GENERAL CONDITIONS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

B. Refer to Division 1 for all requirements pertaining to General Provisions.

C. Provide all the plumbing work in accordance with the Contract Documents.

D. Contractor shall provide adequate training to school personal on the use, operation, and maintenance of plumbing systems.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Outside utilities 5'-0" beyond the building wall.

B. Final connections to heating, ventilating and air conditioning equipment.

C. Cutting and patching.

D. All concrete foundations or bases.

E. Mounting of all starters, except those specified to be factory-mounted and wired as part of the equipment. All wiring necessary to supply power to electric motors and remote operating valves, including connections from the disconnect switches and starters to the motors.

F. Providing the wiring of all plumbing alarm devices excluding house pump controls from the alarm devices to an alarm panel.

G. Motor disconnects switches and circuit breakers, except in combination starters and where otherwise noted.

H. All finished painting of exposed pipes and apparatus.

I. Domestic water meters and detector fire meter.

J. Concrete pits for sump pumping units.

K. Installation of access doors in finished construction furnished as the work of this section.

L. Flashing of roof drains and pipes penetrating the roof.

M. Flashing of floor drains in membrane waterproofed floors.

N. Excavation and backfilling.

O. Extension of fire protection from valved outlets.

P. Bracing and supports for hot water heaters.

Q. Toilet accessories.

R. Contractor shall provide adequate training to school personal on the use and maintained of plumbing systems.

1.3 WORK INCLUDED

A. Plumbing Fixtures and Trim.

B. Sanitary Waste and Vent Systems.

C. Water Supply System.

D. Storm Drainage System.

1.4 DESCRIPTION OF SYSTEMS

A. Provide all plumbing fixtures and trim as indicated on the drawings and as specified elsewhere herein. All fixtures shall be connected to the plumbing systems as indicated and required for

proper operation. Piping materials, accessories, and equipment shall be as specified elsewhere in Division 22.

B. Sanitary Waste and Vent Systems:

1. Provide a complete sanitary, waste and vent system for all fixtures and equipment in the building requiring connections.
2. All waste from the building shall discharge by gravity from the building to 5 feet. outside of building as shown on the drawings.

C. Water Supply System:

1. Provide a complete water supply system for all fixtures and equipment in the building including domestic water heaters.
2. The domestic water system shall connect to 5’-0” outside of building as shown on the plans.
3. Local connections to fixtures and equipment shall be not less than full size of the fittings on the fixtures and equipment, and runouts and risers serving same shall be as shown and not less than one pipe size larger than the fittings on the fixtures and equipment.
4. Provide stop-and-waste valves or ball valves at every branch off water mains where accessible and provide approved gate or compression stops at every connection to fixtures and equipment.
5. Provide shock arresters in accordance with the Plumbing and Drainage Institute Standard PDI-WH201. Provide access door at each location of shock arrester. All shock arresters shall comply with ANSI A112.26.1-1969 (R1975). Coordinate access door locations with the architect.
6. Pressure gauges shall be provided, on the inlet and outlet of all pumps, at the connection to each piece of equipment connected to by the plumbing contractor and at the main service valve in the building. Gauges shall be as specified herein.
7. Thermometers shall be provided, on the inlet and outlet of each water heater, HWR pipe at the discharge of the circulator pump. Thermometers shall be as specified herein.

D. Storm Drainage System:

1. All drain connections to the building storm water system at the lower levels subject to backflow shall be equipped with back water valves.
2. Insulate floor drains receiving cold condensate for a minimum distance of 20'-0" to the vertical stack.

PART 2 - PRODUCTS

2.1 SHOCK ARRESTERS

A. Shock arresters shall be stainless steel, welded nesting type expansion bellows as manufactured by Sioux Chief, Zurn, or Josam. Provide access panels.

2.2 BACKFLOW PREVENTERS

A. 3/4 inch thru 2 inches reduced pressure zone backflow preventers shall be equal to Watts 909 Series with 900AG air gap piped to drain.

B. 2-1/2 inches thru 10 inches reduced pressure zone backflow preventers shall be equal to Watts 909 Series with 909AG air gap piped to drain.

C. Double check valve assembly shall be equal to Watts 709 with UL/FM resilient seated OS&Y valves.

PART 3 - EXECUTION

3.1 PIPING WORK - INSTALLATION

A. The drawings shall be followed where they are definite and provided such procedure causes no objectionable conditions or does not conflict with other trades, laws, regulations, or recommendations of equipment manufacturers. The drawings are intended to indicate the sizes of piping connections, and if certain sizes are omitted or unclear, obtain additional information before proceeding.

3.2 STERILIZATION OF PIPING AND EQUIPMENT

A. After all domestic cold water and hot water supply and return piping has been flushed free of foreign matter, and within 30 days prior to turning the building over to the Owner, this piping shall be sterilized in accordance with Section 22 11 17, “Disinfection of Domestic Water Lines”.

END OF SECTION

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SECTION 22 02 00 - BASIC MATERIALS AND METHODS FOR PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

B. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Piping and equipment identification.

B. Electrical requirements.

C. Painting.

D. Concrete work.

E. Fabricated steel supports.

F. Excavation, trenching and backfilling.

G. Placing of equipment.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this section to the extent referenced.

1. American Institute of Steel Construction (AISC) Publications
2. American National Standards Institute (ANSI) Standards
3. American Society for Testing and Materials (ASTM) Publications
4. American Welding Society (AWS) Publications
5. Underwriters Laboratories, Inc. (UL) Standards

1.4 SUBMITTALS

A. Where submittals are required, comply with Division 1.

B. Shop Drawings: Submit drawings of fabricated steel supports where proposed supports are not in accordance with details on drawings, or where drawings do not detail supports. Submittal for acceptance is required.

C. Product Data: Submittal for other than fabricated steel supports are not required. Product data for the following shall be included in the operation and maintenance manuals. Submittal for acceptance is not required.

1. Piping and equipment identification.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Piping and Equipment Identification:

1. Communications Technology Corp.
2. Craftmark Identification Systems, Inc.
3. EMED Co., Inc.
4. Florida Marking Products, Inc.
5. Marking Services, Inc.
6. Seton Name Plate Corp.
7. W.H. Brady Co., Signmark Division.

2.2 FABRICATION

A. Piping and Equipment Identification:

1. Pipe markers: Sub-surface printed plastic, with protective undercoating. Markers shall be permanently curled for snap-on installation for pipe sizes (including insulation) up to 6 inch diameter. For external diameters above 8 inches. Marker shall be secured using cable ties for indoor use and stainless steel banding or ultraviolet resistant plastic for exterior use. Markers for outdoor installation shall be over-laminated with Tedlar on polyester ultraviolet to avoid damage and fading. Markers shall identify the pipe contents and direction of flow through 360-degree visibility range. Marker size, letter size, letter color, wording and background color shall be in accordance with ANSI A13.1 - Scheme for the Identification of Piping Systems. Based on Marking Services Inc. Model MS-970 Coiled Plastic Markers for indoor use and Model MS-995 Maxilar Marker for exterior use.
2. Valve tags: Contractors Option:
    a. Indoor:
        i. 19 gauge brass, 1-1/2 inch round, with 1/4 inch high black pipe service letter abbreviation above 1/2 inch high black valve number. Pipe service letter abbreviation shall be in accordance with legend on drawings. Valve tag attachment shall be 4 ply 0.018 copper wire meter seal or #6 solid brass bead chain with locking link. Based on Marking Services Inc.
        ii. 1/16 inch thick plastic, 1-1/2 inch round, with 1/4 inch high black pipe service abbreviation above 1/2 inch high black valve number. Pipe service letter abbreviation shall be in accordance with legend on drawings. Color of valve tag shall match pipe marker color. Valve tag attachment shall be 4 ply 0.018 copper wire meter seal or #6 solid brass bead chain with locking link. Based on Marking Services Inc.
    b. Outdoor Service:
        i. 19 gauge brass, 1-1/2 inch round, with 1/4 inch high black pipe service letter abbreviation above 1/2 inch high black valve number. Pipe service letter abbreviation shall be in accordance with legend on drawings. Valve tag attachment shall be 4 ply 0.018 copper wire meter seal or #6 solid brass bead chain with locking link. Based on Marking Services Inc.
        ii. 19 gauge Type 304 stainless steel, 1-1/2 inch round, with 1/4 inch high pipe service abbreviation above 1/2 inch high black valve number. Pipe service letter abbreviation shall be in accordance with legend on drawings. Color of valve tag shall match pipe marker color. Valve tag attachment shall be 4 ply 0.018 stainless wire meter seal or #6 Type 304 stainless steel bead chain with locking link. Based on Marking Services, Inc.
3. Valve chart frame: Self-closing, satin-finished, extruded aluminum with glass window, 8-1/2 inch by 11 inch chart size.
4. Equipment nameplates:
    a. Indoor: Shall be 1/16 inch thick plastic with black satin surface and white core. Lettering shall be engraved through the surface color to expose the core color. Plate size shall be a minimum of 2-1/2 inch by 4 inch, with 3/4 inch high lettering for equipment and 3/4 inch by 2-1/2 inch, with 3/16 inch high lettering for ceiling grid labeling. Equipment identifying name and number shall be in accordance with schedules on the Contract Documents. Plate manufacturer shall furnish pre-drilled hole locations for pop riveting. Where pop riveting is not suitable, a suitable adhesive for permanently attaching plate to equipment shall be provided.

b. Outdoor: Shall be 125 Mil rigid plastic constructed of printed legend sealed between two layers of chemically-resistant plastic to resist ultraviolet damage. Plate size shall be a minimum of 2-1/2 inch by 4 inch, with 3/4 inch high lettering for equipment. Equipment identifying name and number shall be in accordance with schedules on the Contract Documents. Plate manufacturer shall furnish pre- drilled hole locations for pop riveting. Where pop riveting is not suitable, a suitable adhesive for permanently attaching plate to equipment shall be provided.

c. Based on Marking Services Inc. Model MS-215 Max-Tex.

B. Electrical Requirements: Refer to Division 26 for requirements

C. Painting: Product specified in Division 9 - FINISHES.

D. Concrete Work:

1. Concrete is provided under DIVISION 3 - CONCRETE.
2. This contractor to provide detailed dimension drawings, including anchor bolt locations where required for all bases and pads required for equipment furnished under this Division.
3. Concrete for equipment bases and pads shall be 3000 psi. design mix prepared in accordance with ASTM C94. Cement shall be in accordance with ASTM C150. Aggregate shall be fine sand in accordance with ASTM C33. Water shall be clean, fresh, and drinkable.

E. Fabricated Steel Supports:

1. Steel angles, channels, and plate shall be in accordance with ASTM A36.
2. Steel members, including fasteners, exposed to weather shall be galvanized.

F. Excavation, Trenching, and Backfilling: Product description not applicable.

G. Placing of Equipment: Product description not applicable.

PART 3 - EXECUTION

3.1 GENERAL

A. Installation of materials and equipment shall be in accordance with the manufacturer's written instructions, except as specified.

3.2 INSTALLATION

A. Piping and Equipment Identification:

1. Install pipe markers adjacent to each valve and fitting, at each branch connection, on each side of wall, floor, and ceiling penetrations, where entering and leaving underground areas, and at minimum 40 foot spacing on horizontal and vertical pipe runs. Markers shall be arranged for easy reading at eye level.
2. Provide valve tags on all valves exposed or concealed unless otherwise noted.
3. Attach valve tag to stem of each valve to be tagged. Valve numbers shall follow in sequence the Owner's existing valve numbers, where applicable.
4. Provide a marker for each valve and equipment to be tagged, located above lift-out tile ceilings. The marker shall be 1/16 inch thick plastic with a satin surface and white core. Color of the marker shall match color of piping identification system. Lettering shall be engraved through the surface color to expose the core color. Plate size shall be 3/4 inch by 2-1/2 inch, with 3/16 inch high lettering for ceiling grid labeling. Plate manufacturer shall furnish suitable adhesive for permanently attaching plate to ceiling grid.
5. Provide a minimum of 4 valve charts. Chart information shall indicate job name, Contractor name, date of installation, valve number, valve location, valve type, valve purpose, and system in which installed. Mount framed chart in equipment room and insert copy of chart in each operating and maintenance manual under separate tabbed section labeled "Valve Chart". Where project drawings include a piping flow schematic, request AutoCAD file from

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Engineer and label all of the valves according to the valve chart and frame in an 18” x 24” frame in main mechanical or pump room.

6. Permanently affix nameplate to each item of equipment using stainless steel pop rivets. Where irregular surface impedes direct attachment of plates, affix plate to sheet metal bracket and attach bracket to equipment with screws, bolts or suitable adhesive from nameplate manufacturer.

B. Electrical Requirements: All work provided under Division 26.

C. Painting:

1. All equipment shall be furnished with a factory- applied galvanized, prime paint, or finish paint finish. Touch-up damaged surfaces of equipment immediately.
2. Paint for galvanized surfaces shall be in accordance with ASTM A780 using zinc rich compound.
3. Paint wooden mounting backboards with two coats of gray enamel prior to making attachments to the board.
4. For quality control refer to DIVISION 9 - FINISHES.
5. Remove all dirt, rust, scale, grease, pipe dope, solder flux, and welding slag from all surfaces to be painted.
6. Paint immediately, under this Division, all damaged galvanized surfaces. Paint galvanized metal surfaces behind grilles with two coats of flat black paint.
7. Apply rust inhibitive primer to ferrous surfaces of shop fabricated steel supports.
8. Paint immediately under this division all field and shop welded joints in piping or equipment supports with 2 coats of grey metal primer.

D. Concrete Work: All work as provided by Division 3.

E. Fabricated Steel Supports:

1. Because of the small scale of the drawings, details of equipment support are not always shown. It shall be the responsibility of the contractor to provide supports as required for safe and adequate support.
2. Fabricated steel supports and ladders may be shop or field-fabricated and shall be in accordance with details on drawings.
3. When details are not indicated, the contractor shall submit proposed support details for review. The contractor shall bear all cost in producing this detail in the bid. This includes but is not limited to structural engineering support.
4. Steel members shall be saw cut, with corners ground smooth, and shall be assembled with welded or bolted connections at Contractor's option. Connections shall be in accordance with specified AISC Publications.

F. Excavation, Trenching, and Backfilling: Excavation, trenching, and backfilling for site utility piping systems specified in DIVISION 31.

G. Placing of Equipment:

1. Coordinate setting of equipment with the requirements of other trades so as to avoid conflicts and to insure compatibility. Equipment shall not block access for installation of other equipment.
2. Set base mounted equipment on permanent and finished supports. Temporary support, if any, shall be removed prior to making final pipe, duct, or electrical connections to equipment.
3. Adjust suspended equipment to final elevation prior to making pipe, duct or electrical connections.

4. Exercise caution during equipment placing operations to ensure that structure is not overloaded.
5. Do not move heavy equipment across floor or roof of insufficient load bearing capacity to support such equipment. Provide bracing or shoring as required or use crane to place equipment directly on permanent and finished support.
6. Secure all roof mounted equipment to the structure adequately to resist overturning, uplift and sliding forces for basic wind speeds indicated for this location in Figure 1609 of the Florida Building Code, Latest Edition.

END OF SECTION

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SECTION 22 05 00 - COMMON WORK RESULTS FOR PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

B. Comply with Sections 01 33 00, “Submittal Procedures” and 01 60 00, “Material Equipment and Approved Equals”.

1.2 ARTICLES INCLUDED

A. Definitions.

B. Permits, Fees and Notices.

C. Applicable Publications.

D. Code Compliance.

E. Scope of Work.

F. Record Drawings.

G. Intent of Drawings and Specifications.

H. Quality Assurance

I. Submittals.

J. Product Requirements - Equals and Substitutions.

K. Manufacturer’s Instructions.

L. Transportation and Handling.

M. Storage and Protection.

N. Cutting, Patching and Demolition.

O. Cleaning Up/Removal of Debris.

P. Operating and Maintenance Manuals.

Q. Training of Owners Operators.

R. Guarantee of Work.

S. System Testing.

1.3 ARTICLES

A. Definitions:

1. The term "As indicated" means as shown on drawings by notes, graphics, or schedules, or written into other portions of contract documents. Terms such as "shown", "noted", "scheduled" and "specified" have same meaning as "indicated" and are used to assist the reader in locating information.

2. The term "Provide", means furnish and install as part of the work covered in Division 22.

3. The term "Furnish" means furnish only, for installation, as part of this contract, by other Divisions.

4. The term "Install only" means to install under the work of Division 22 equipment furnished by other Divisions, or by the Owner.

5. The term "Owner's Representative" when referenced herein shall be the Architect or the Engineer acting as his designated representative unless otherwise noted.

6. The term "design" as it pertains to the work of this division shall describe the basic intent, component sizing, component relationships and overall architecture of the Plumbing

system. The design is generally schematic in nature and will require specific detailing after the accepted products are determined.

7. The term "detail" as it pertains to the work of this division shall describe the work required by the contractor to assure a fully coordinated installation of the material and equipment supplied. When requested, the contractor shall produce detailed shop drawings or sketches indicating the actual placement of the equipment or material supplied; also including how the equipment or material interfaces with work of other sections or divisions within the contract documents.
8. The term "workman-like manner" as it pertains to the work of this division shall describe a neat well-organized high-quality installation system (piping, etc.). Routing shall be well thought out providing adequate service clearance and maximum use of space. Equipment placement shall exhibit proper clearances for service. All lines (piping, etc.) shall be run straight and true, parallel, or perpendicular to building structure neatly supported.
9. For additional definitions refer to the General Conditions.

B. Permits, Fees and Notices: Comply with the General Conditions.

C. Applicable Publications:

1. Publications listed in each section form a part of that section to the extent referenced.
2. When a standard is specified by reference, comply with requirements of that standard, except when requirements are modified by the Contract Documents, or applicable codes establish stricter standards.
3. The Publication or Standard is the publication in effect as of the bid date, except when a specific date is listed.

D. Code Compliance:

1. Life Safety Code - NFPA 101
2. Florida Building Code, 8th Edition (2023)
3. Florida Accessibility Code, 2020
4. National Electrical Code 2017
5. Florida Plumbing Code, 8th Edition (2023)
6. State Requirements for Educational Facilities (SREF), 2014
7. NFPA Standards, Latest Edition.

E. Scope of Work: The work to be performed under this Division consists of the satisfactory completion of all plumbing as indicated in the Contract Documents.

F. Record Drawings: Comply with the General Conditions.

G. Intent of Drawings and Specifications:

1. The intent of the drawings and specifications is to establish minimum acceptable quality standards for materials, equipment, and workmanship, and to provide operable plumbing systems complete in every respect.
2. Existing conditions, dimensions, etcetera, depicted on the drawings are taken from the "as-built" drawings of the original construction supplemented by field observation. The contractor is cautioned to field verify all existing conditions, dimensions, etcetera, notifying the Owner's Representative of any discrepancies other than those minor in nature, for direction, prior to ordering or fabricating equipment or materials. Anything mentioned in the specifications and not shown on the drawings or shown on the drawings and not mentioned in the specifications, shall be of like effect as if shown or mentioned in both. In case of difference between drawing and specifications, the more stringent shall govern, unless the discrepancy conflicts with applicable codes, wherein the code shall govern. The drawings are diagrammatic, intending to show general arrangement, capacity,

and location of system components, and are not intended to be rigid in detail. Final placement of equipment, other system components, and coordination of all related trades shall be the contractor's responsibility.

3. Due to the small scale of the drawings, and to unforeseen job conditions, all required offsets and fittings may not be shown but shall be provided at no additional change in contract cost.
4. In the event of a conflict, the Owner's Representative will render an interpretation in accordance with the General Conditions.

H. Quality Assurance:

1. All equipment furnished under this Division shall be listed and labeled by U.L., ETL or a nationally recognized testing laboratory (NRTL).
2. Material furnished under this Division shall be standard catalogued products of recognized manufacturers regularly engaged in the production of such material and shall be the latest design.
3. Materials shall be the best of their respective kinds. Materials shall be new except where the specifications permit reuse of certain existing materials.
4. Work provided for in these specifications shall be constructed and finished in every part in a workmanlike manner.
5. All items necessary for the completion of the work and the successful operation of a product shall be provided even though not fully specified or indicated on the drawings.
6. All work to be performed by qualified and experienced personnel specifically trained in their respective field.
7. All work of this division shall be carefully interfaced with the work of other divisions to assure a complete, functioning system or systems.

I. Submittals:

1. In addition to all other submittal requirements elsewhere in the contract documents, the contractor shall comply with the following.
2. Submittal for acceptance is required only on those items specifically requested in the specification section that applies.
3. For products and equipment that do not require a submittal for acceptance, submit a separate letter for each specification section certifying that all products and equipment will be provided in compliance with the contract documents.
4. Provide submittal data in accordance with the General Conditions and/or as listed below.
5. Designate in the construction schedule, or in a separate coordinated schedule, the dates for submission and the dates that the submittals will be needed in order to meet construction schedule. This schedule shall be submitted prior to or in conjunction with the first submittal. Processing of submittals may be delayed pending the receipt of this schedule at the reviewer’s discretion.
6. Submittal data shall be presented in a clear and thorough manner and referenced to the specification section.
    a. Where applicable, data shall be identified by reference to sheet and detail, schedule or room numbers, equipment or unit number as shown on Contract Drawings.
7. Prepare performance and product data as follows:
    a. Clearly mark each copy to identify pertinent products or models, delete non- pertinent data.
    b. Show performance characteristic and capacities.
    c. Show dimensions and clearances required.

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d. Show wiring or piping diagrams and controls.

e. Clearly list any deviation in the submittals from the requirements of the contract documents.

f. Include installation requirements.

8. Manufacturer's standard schematic drawings and diagrams:
   a. Modify drawings and diagrams to delete information not applicable to the work of this project.
   b. Supplement standard information to provide information specifically applicable to the work of this project.
9. Prohibition of Asbestos and PCB:
   a. The use of any process involving asbestos or PCB, and the installation of any product, insulation, compound of material containing or incorporating asbestos or PCB, is prohibited. The requirements of this specification for complete and operating mechanical systems shall be met without the use of asbestos or PCB.
   b. Prior to the Final Review field visit the Contractor shall certify in writing that the equipment and materials installed in this Project under this Division 22 contain no asbestos or PCB. Additionally, all manufacturers shall provide a statement with their submittal that indicates that their product contains no asbestos or PCB. This statement shall be signed by a duly authorized agent of the manufacturer.
10. Letter of Certification: Where a submittal is not required, provide letter certifying that the work will be completed in strict accordance with the specified requirements. In the event the contractor wishes to alter the requirements of the specification for whatever reason, this should be clearly explained in this letter noting that this alteration may require additional submittal requirements.
11. Schedules: Where schedules are called for, submit schedule indicating which products will be used and to what extent by system, location, size, etc.
12. Where samples are requested, samples shall be of sufficient size and quantity to clearly illustrate:
    a. Functional characteristics of the product, with integral related parts and attachment devices.
    b. Full range of color, texture, and pattern.
    c. Where a mock-up is specified, erect at the Project site, in a location acceptable to the Owner's Representative. Size or area shall be that specified or as agreed upon during pre-construction or other job site meetings.
    d. Where mock-up is not a permanent part of the installation, remove mock-ups at conclusion of work or when acceptable to the Owner's Representative.
13. The Contractor shall:
    a. Review Shop Drawings, Product Data and Samples prior to submission.
    b. Determine and verify:
       i. Field measurements.
       ii. Field construction criteria.
       iii. Catalog numbers and similar data.
       iv. Conformance with specifications.
       v. All submittals have been properly interfaced with the requirements of this and other divisions of work so as to assure a complete, functioning system in accordance with the contract documents.

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c. Coordinate each submittal with requirements of the work and of the Contract Documents.

d. Clearly identify any deviations in the submittals from requirements of the Contract Documents. Any deviations not specifically disclosed in the submittal shall be solely at the risk of the Contractor and shall be subject to discovery at any time. Any undisclosed deviations shall be corrected by the Contractor to comply with the requirements of the Contract Documents at no cost to the Owner regardless of the action code accorded the submittal by the Owner's Representative.

e. Do not release equipment for shipment, begin fabrication or work on any items requiring submittals for acceptance until all submittals are returned with the Owner's Representative acceptance.

f. Make submittals promptly, and in such sequence as to cause no delay in the work or in the work of any other contractor.

14. Number of Submittals: Comply with the Division 1, Specification Section 01 33 00, “Submittal Procedures”.

15. Submittals shall contain:

a. The date of submission and the dates of any previous submissions.

b. The Project title and number.

c. Contract identification.

d. The names and phone numbers including personal contact of:

i. Contractor.

ii. Supplier.

iii. Manufacturer.

e. Identification of the product, with the specification section number and contract document description clearly indicated.

f. Field dimensions clearly identified as such.

g. Relation to adjacent or critical features of the work or materials.

h. Applicable standards.

i. Identification of deviations from Contract Documents.

j. Identification of revisions on re-submittals.

k. Contractor's stamp, initialed or signed, certifying to review of submittal, verification of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.

l. Each submittal shall be limited to a single specification section. Submittals shall not be grouped with other sections in common binders or under common control sheets except as defined in paragraph m. below. Each submittal shall have a cover/control sheet containing the information listed above (a thru k) and have a minimum of 8" x 3" clear space for the general contractors, engineers and architects review stamp.

m. The first group of submittals shall be sent in a minimum of one (or if required) two hard cover view type 3-ring binder(s) White, sized to hold 8-1/2” x 11” sheets:

i. Binder is to be adequately sized to comfortably hold required submittals. Minimum spline size to be 1 inch, maximum spline size to be 3 inches (provide additional binders if 3 inches size is not sufficient to properly hold submittals).

ii. Binder cover and spline to have outer clear vinyl pockets. Provide correct designation of project in each pocket. Description sheets are to be white with

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black letters, minimum of 11 inches high and full width of pocket. Description is to describe project and match project drawing/project manual description.

iii. Submittals not complying with these requirements may be returned with no action taken at the reviewer's discretion.

16. Re-submittals shall contain:
    a. The date of re-submission and the dates of all previous submissions.
    b. A copy of the Engineer's comments from the previous submittal.
    c. An itemized response to each of the Engineer's comments specifically outlining the changes or corrections being made. As an example, this could be either noting the page(s) of the previous submission that are affected and what changes have been made or noting specific additional information being provided.
    d. Submittals not complying with these requirements may be returned with no action taken at the reviewer's discretion.
    e. Turnaround time and copies as indicated in Section 01 33 00, "Submittal Procedures".
17. The Owner's Representative will (if they so desire):
    a. Review submittals promptly and where special attention is requested, review in accordance with the schedule required.
    b. Review the submitting of the submittal for general compliance with the contract documents. The contractor is responsible for quantities, dimensions, placement of the product, coordination with all other trades occupying the space, maintain service clearance, function, and compliance with the written installation instructions.
    c. Determine the appropriate action for the submittal. Action codes will be as follows:
        i. "NO EXCEPTIONS TAKEN" - Copies will be distributed as indicated under above schedule.
        ii. "NOTE MARKINGS/CONFIRM" - Final but Restricted Release; General Contractor may proceed with fabrication, taking into account the necessary corrections on submittal and with Contract Documents. General Contractor must submit a confirmation letter to remove restriction and allow shop drawings on the project site. A sample of a confirmation letter is enclosed herein.
        iii. "NOTE MARKINGS/RESUBMIT" - General Contractor may proceed with fabrication, taking into account the necessary corrections. Corrected shop drawings shall be resubmitted before fabrication of this work is complete to obtain a different action marking. Do not allow drawings marked, "Resubmit" to be used in connection with installation of the Work.
        iv. "REJECTED/RESUBMIT" - General Contractor will be required to resubmit shop drawings in their entirety. No fabrication or installation shall be started until shop drawings so marked have been completely revised, resubmitted, and marked by Architect according to preceding Paragraphs a. or b.
    d. Turnaround time will be per Division 1.
    e. Review comments will be per Division 1.
18. Resubmission requirements for "as specified" products.
    a. Make any corrections or changes in the submittals required by the Owner's Representative and resubmit until accepted.
    b. A submittal shall only be reviewed a maximum of 3 times. If upon the second resubmission an accepted action cannot be rendered (No Exceptions Noted or Make Corrections as Noted), the contractor shall supply the basis of design product and

bear all costs incurred by the Engineer during the review process until an accepted submittal is achieved.

19. The Contractor shall maintain one copy of all accepted submittal data including letters of compliance in a job site file.

J. Product Requirements, Equals and Substitutions:

1. In addition to all other requirements for submittals, equals and substitutions elsewhere in the contract documents, the contractor shall comply with the following.
2. Product Requirements:
   a. The specifications sections under Article 2.1 "ACCEPTABLE MANUFACTURER", lists suppliers found acceptable for this project. The names listed are manufacturers who meet the minimum acceptable standards that this project dictates. The list is furnished as a guide. Even though a manufacturer is named, he must still provide the type and quality of equipment specified as well as equipment that will fit within the allotted space and within the design weight allowance, etc. Being named does not imply permission for that manufacturer to provide an alternative product or design. Other manufacturers not named will be considered to be equal providing they furnish a product of the type and quality specified.
   b. In certain cases, foundations and/or structural supports or electrical requirements for equipment specified in this Division are provided under other divisions of the specifications. Where an alternate acceptable manufacturer's product is provided, this contractor shall coordinate the revised requirements and include an allowance for any cost differential.
   c. If the list, under Article 2.1 "ACCEPTABLE MANUFACTURERS" names only one manufacturer followed by "No Substitutions" that product shall besupplied.
3. Substitutions: Comply with the General Conditions, but the following are in addition to:
   a. A substitution is defined as any product not meeting the requirements as outlined in PART 2 - PRODUCTS. A different design accomplishing the same result will be considered a substitution. The same design requiring a larger motor, or more space or a structural change to accommodate larger weight, etc., will be considered a substitution. If a manufacturer who is not listed as an "ACCEPTABLE MANUFACTURER" wants to have his product considered as an equal or as a substitution, he shall submit details to the Engineer 10 days in advance of bid date and a decision will be rendered. If necessary, a clarification will be issued in the form of an Addendum. No substitution requests shall be considered after the Bid.
   b. Submit a separate request for each product, supported with complete data, with drawings and samples as appropriate, including.
      i. Comparison of the qualities of the proposed substitution with that specified in tabulated format.
      ii. Changes required in other elements of the work because of the substitution.
      iii. Effect on the construction schedule.
      iv. Cost, extra credit or statement of no change in contract price.
      v. Any required license fees or royalties.
      vi. Availability of maintenance service, and source of replacement materials.
   c. The Engineer shall be the judge of the acceptability of the proposed substitution.
   d. A request for a substitution constitutes that the Contractor:
      i. Has investigated the proposed product and determined that it is equal to or superior in all respects to that specified.

ii. Will provide the same warranties for the substitution as for the product specified.

iii. Will coordinate the installation of the substitution into the work and make such other changes as may be required to make the work complete in all respects.

iv. Waives all claims for additional costs, under his responsibility, which may subsequently become apparent.

v. Will absorb all costs incurred by the substitution when affecting other trades including but not limited to electrical, structural, architectural, etc.

vi. Will absorb any cost incurred by the Engineer in review of the substituted product if the acceptance of the substituted item creates the need for system modification and/or redesign, or if the substituting contractor exhibits negligence in his substituting procedure thus submitting inferior, misapplied or miss-sized equipment. In the event of additional engineering costs, the billing structure shall be agreed upon prior to review by all involved parties.

4. Engineer will review requests for substitutions with reasonable promptness, and will issue an addendum or notify Contractor, in writing, of the decision to accept or reject the requested substitution.

5. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or if acceptance requires revision to the contract documents.

6. The engineer will review substitution submittals for compliance a maximum of two times. If the submittal or substituted product does not comply with the contract documents on the second submittal, the submittal and product will be rejected and the specified product will be required.

7. The contractor may request further review of the substitution after the second submittal rejection if the contractor agrees in writing to accept responsibility for the cost of additional review time and expenses by the Engineer.

8. In the event a substitution is rejected, supply the products which constituted the basis of design at no change in the contract price.

9. Installation of substitutions without the Owners approval shall be cause of immediate rejection and removal without extra cost to the Owner.

K. Manufacturer's Instructions:

1. Installation of work shall comply with manufacturer's printed instructions.

2. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with Engineer for clarification. Do not proceed with work without clear instructions.

L. Transportation and Handling: Comply with General Conditions.

M. Storage and Protection:

1. Store products in accordance with manufacturer's instructions, with seals and labels intact and legible.

2. Store products to prevent damage by the elements. Space temperature shall be controlled as required to prevent condensation and metal corrosion or damage to electrical or electronic parts are the result of condensation.

3. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions, and free from damage or deterioration.

4. Provide protection as necessary to prevent damage after installation.

5. Products which suffer damage due to improper storage shall not be installed and if found in place, shall be removed and replaced at the contractor’s expense.

N. Cutting and Patching: Comply with the General Conditions.

O. Cleaning Up/Removal of Debris:

1. Comply with the General Conditions.
2. Maintain a clean work area. Construction debris shall be immediately removed from all newly erected work.

P. Operating and Maintenance Manuals: Comply with the General Conditions, but the following are in addition to:

1. Quantity: Comply with the General Conditions.
2. Format: Adequately sized for contents, minimum 1 inch and maximum 3 inches spline size, hard cover, view type, 8-1/2" x 11” loose leaf binders. Binder covers to have outer clear vinyl pocket on front cover and spline. Provide correct project designation and contents description in each pocket. Use as many as required. Do not overload binders.
3. Content:
    a. Cover sheet.
    b. Table of contents (as follows):
        i. Description of systems.
        ii. Design parameters.
    c. Point by Point System Check-out: Provide tabulated results indicating compliance with contract document requirements.
4. Detailed Preparation Requirements:
    a. The cover sheet shall list project name, location, architect, structure engineer, mechanical engineer and electrical engineering firm name with address, telephone number and project manager’s name for this project.
    b. Each major heading in the table of contents shall have a large distinctive, clearly marked, non-erasable, plastic encased tab.
    c. The description of systems will be provided by the design engineer for insertion at the time of review and turn-over to owner. This description of systems will be an updated version of the narrative included in this Section and will be an overview of the entire system. It will be the basis for the starting of the owner’s instruction program.
    d. Each section shall have the following sub-tabs. Sub-tabs shall be similar to the main tabs but of a different color.
        i. Specifications: The specification shall be copied and inserted complete with all addenda.
        ii. Submittal: This section shall include all accepted submittal data. If submittal was not required, include technical data as specified.
        iii. Installation Instructions: If the product, such as pipe, etc., does not have any written installation instructions, include a statement "Manufacturer's Written Installation Instructions Not Available - Product Installed in accordance with Specifications and Good Practice".
        iv. Operation and Maintenance Instructions: These shall be the written manufacturer's data edited to omit reference to products or data not applicable to this installation.
        v. Parts List: These shall be edited to omit reference to items not applying to this installation.
        vi. Equipment Supplier: This section shall include the name, address and telephone number of the manufacturer's agent and/or service agency supplying or installing and starting up of the equipment.
        vii. System Description: This section shall include that portion of the overall

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description included in the beginning of the manual as it applies to each sub-section. In sections such as pipe, valves and fittings, a statement shall be included "Not Applicable to this section." Data for this section will be added by the design engineer when the manuals are submitted for review and forwarded to the owner.

Q. Training of Owners Operators:

1. The manufacturer shall provide a comprehensive training outline for the Owner & Engineer to review within 90 days of final completion.
2. The manufacturer & contractor shall provide training on the plumbing system, plumbing fixtures and all water heating systems, per the table below.
3. The owners shall be given comprehensive training in the understanding of the systems and the operation and maintenance of each major piece of equipment.
4. The contractor shall be responsible for scheduling the training which shall start with classroom sessions followed by hands on training on each piece of equipment. Hands on training shall include start-up, operation in all modes possible, shutdown and any emergency procedures.
5. The manufacturer's representative shall provide the instructions on each major piece of equipment. These sessions shall use the printed installation, operation and maintenance instruction material included in the O&M manuals and shall emphasize safe and proper operating requirements and preventative maintenance.

R. Guarantee of Work:

1. Comply with the General Conditions.
2. Where applicable, furnish manufacturer's written warranty for materials and equipment.
3. Insert warranties in appropriate locations in operating and maintenance manuals.
4. Materials and equipment having seasonal operation limitations shall be guaranteed for a minimum of one year from date of seasonally appropriate test, and acceptance in writing by the Owner, unless specific Division 22 specifications specify a longer period.

S. System Testing:

1. Provide all necessary labor, materials, and equipment to successfully complete all system testing necessary for building occupancy and owner acceptance.
2. Provide all necessary labor, materials, and equipment to assist contractors of other division to complete system testing necessary for building occupancy and owner acceptance, wherever an inter-relationship between Division 22 and the work of other divisions exists.
3. Tests shall be repeated as necessary until all occupancy and operation permits are granted and the owner accepts the project.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOTAPPLICABLE)

END OF SECTION

SECTION 22 05 19 - METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

B. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Thermometers and Accessories.

B. Pressure Gauges and Accessories.

C. Pressure and Temperature Test Ports.

D. Install Miscellaneous Control Devices.

1.3 SUBMITTALS

A. Submit schedule of all products used. Include make, model and size. When multiple products will be used, generic size and flow range will be acceptable.

B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

C. Refer to Division 1 for submittal requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Thermometers and Accessories:

1. Duro Instrument Corp.
2. Taylor
3. H.O. Trerice
4. Weiss
5. Weksler
6. Winter’s Thermo-Gauges

B. Pressure Gauges and Accessories:

1. Ashcroft
2. Duro Instrument Corp.
3. H.O. Trerice
4. Weiss
5. Weksler
6. Winter’s Thermo-Gauges

C. Pressure and Temperature Test Ports:

1. Peterson Equipment Co., Inc.
2. Sisco P/T Plugs
3. Or equal

2.2 FABRICATION

A. Thermometers and Accessories:

1. Industrial Reading Non-Mercury Type:
    a. Construction: Adjust angle, 9 inch scale with lagging extension brass well, of the blue fill type and guaranteed accurate to ± one scale division. Thermometer shall have glass front to exclude dirt and dust. Thermometers containing mercury are not acceptable. Thermometers installed outdoors shall be specifically designed and weatherproofed for this application.
    b. Stem Length:
        i. 6 inch pipe and smaller: 3-1/2 inches
        ii. 8 inch to 12 inch pipe: 6 inches
        iii. For storage tanks: 9 inches
    c. Ranges:
        i. Chilled and condenser water 0 to 120-degrees F or 0 to 100-degrees F as available.
        ii. Domestic & heating hot water 30 to 240-degrees F
    d. Based on Weksler Type EG5H-9
2. Bi-Metal Dial Type:
    a. Construction: 5 inch dial, adjust-angle, with lagging brass extension well. Stainless steel case bezel, fittings, and stem. Head assembly sealed against dust, fumes, and moisture with glass window. Accuracy of ± 1% of thermometer range and be externally adjustable.
    b. Stem Length:
        i. 6 inch pipe and under: 2-1/2 inches
        ii. 8 inch to 12 inch pipe: 4-1/2 inches
        iii. For storage tanks: 7-1/2 inches
    c. Range:
        i. Chilled and condenser water 0 to 150-degrees F
        ii. Domestic & heating hot water: 20 to 240-degrees F
    d. Based on Weksler Type AF.
3. Thermometer Well: Construction - Brass or ductile iron body, with lagging extension, length to accommodate thermometer stem length. Based on Weksler.

B. Pressure Gauges and Accessories:

1. Pressure Gauges:
    a. Construction: 4-1/2 inch dial, high impact polypropylene case, 1/4 inch bottom connection, 1/2% accuracy in accordance with ANSI B40.1 - 1974 Grade A. Stainless steel rotary with stainless steel pinion gear; stainless steel sector gear; stainless steel link. Stainless steel bourdon tube, 316 stainless steel socket and slotted adjustable pointer.
    b. Case of black high impact polypropylene suitable for surface or direct mounting and with bottom connection. For outdoor locations, provide glycerin filled gauges.
    c. Range: Ranges shall be selected to indicate pressure reading in midpoint of scale selected.

d. For condenser water, ice water and other open system pumps, provide a compound gauge with dial calibrated to read in. hg. vac. as well as pressure.

e. Based on Weksler Model AA44-2 and AY44-2.

2. Manifold Valves (Trumpet Valve) (Water): - 2, 3 or 4 port - Brass body, spring return, push button brass valves, 1/4 inch compression connections. Gauges tap at top, calibrated gauge test port with gauge cock. 125 PSIG rated, 20-degrees F to 220-dregrees F range. Based on Flow Conditioning Corporation Hydronic Indicator System.

3. Piston type snubber: Brass body, threaded connections, suitable for mounting horizontal or vertical. (Required at pump inlet and discharge.) Based on Weksler Type RS-1.

4. Filter type snubber: Brass body, threaded connection, micro metallic stainless steel filter. (For all gauges except pump service). Based on Weksler Type BW42.

5. Siphon: Iron, straight or right angle rated at 500 PSIG steam. (For steam and high temperature hot water systems). Based on Weksler A03I.

C. Pressure and Temperature Test Ports:

1. Brass or stainless-steel body with threaded cap and gasket, length to extend past insulation.

2. Two self-closing valves with intermediate pocket for added pressure protection. Sized for standard 1/8 inch probe.

3. Range: 20-degrees F to 230-degrees F.

4. Rating: 250 PSIG water.

5. Based on Peterson Equipment Co., Inc. "Pete's Plug" Model 110XL.

PART 3 - EXECUTION

3.1 GENERAL

A. Install in accordance with manufacturers written installation instructions.

3.2 INSTALLATION

A. Thermometers and Accessories:

1. Install and adjust thermometers for optimum visibility.

2. Provide thermometers indicated on schematic flow diagram or schematic equipment details.

3. Install thermometers in compatible thermometer wells.

B. Pressure Gauges and Accessories:

1. Install and adjust gauge for optimum visibility.

2. Provide ball valve shut-off for all hydronic gauges.

3. Provide needle valve for all steam gauges.

4. Provide siphon for all steam gauges.

5. Provide a manifold valve to facilitate the use of a single gauge to monitor pressure differential from various points of a single piece of equipment (i.e. pump; strainer suction; pump suction; pump discharge, etc.). Mount valve for optimum visibility and access.

6. In lieu of the trumpet valves the contractor may assemble individual components using ball valves as the isolation valve provided the same functions of the trumpet valve are duplicated.

7. Provide piston type snubbers for pump service.

8. Provide filter type snubbers for all other fluid services.

9. Open shut-off valve only enough to obtain accurate reading. Valve to gauge to be closed at all other times.

C. Pressure and Temperature Test Ports:

1. Install in upright or vertical position as indicated on schematic flow diagram or schematic equipment details.
2. Install in tee or welded outlet.

D. Install miscellaneous control devices such as thermometer wells, tees for flow measuring stations, connections for differential pressure sensors, etc.

END OF SECTION

SECTION 22 05 23 - VALVES FOR PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and supplementary Conditions and Division 1 Specification Sections, apply to this section.

B. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Automatic Flow Control Valves.

B. Ball valves.

C. Check valves.

D. Combination Automatic Flow Control and Shutoff Valves.

E. Drain valve.

F. Lubricated Plug Cock.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this Section to the extent referenced. The publications are referenced to in the text by the basic designation only.

1. American National Standards Institute (ANSI).
2. American Society for Testing and Materials (ASTM).

1.4 SUBMITTALS

A. Submit schedule and cut-sheets indicating service, make and model number, pressure class, end type and usage (i.e., balance, shut-off).

B. Product data shall be included in the operation for maintenance instruction manuals along with installation, operation, and maintenance instructions.

C. Refer to Division 1 for Submittal requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Automatic Flow Control Valves:

1. Flow Design, Inc.
2. Griswold Controls.

B. Ball Valves:

1. Apollo
2. Viega
3. Milwaukee Valve.
4. Nibco, Inc.
5. Stockham
6. Victaulic Co. of America.

C. Check Valves:

1. API International, Inc.
2. Milwaukee Valve
3. Mueller Steam Specialty, Co. (Muessco)

4. Nibco, Inc.
5. Stockham
6. Victaulic Co. of America.
7. Walworth

D. Combination Automatic Flow Control and Shutoff Valves:
1. Flow Design, Inc.
2. Griswold Controls

E. Drain Valves:
1. Apollo.
2. Nibco, Inc.
3. Watts

F. Lubricated Plug Cock:
1. DeZurik
2. Milliken Valve Company
3. Rockwell Mfg. Co.
4. Resun
5. Walworth

2.2 FABRICATION

A. Automatic Flow Control Valves:
1. Potable Water Service:
a. Size 1/2 inch thru 2-1/2 inches: Brass wye body design, thread or sweat connection, ground joint union, dual temperature and pressure test ports extended to clear required insulation, range 20-degrees F to 230-degrees F rated at 400 psi water. Stainless steel or nickel-plated piston brass orifice and spring, replaceable without removing from installation, factory set to control the flow rate within 5% of the tagged rating over an operating pressure differential of at least 10 times the minimum required for full flow condition. GPM and direction of flow shall be clearly marked on flow control valves. Wide open pressure drop shall not exceed 10 ft. Valves shall be calibrated for the fluid being pumped. Based on Flow Design, Inc. AutoFlow Model YR

B. Ball Valves:
1. Potable water service:
a. Size 1/4 inch thru 2 inches. Brass body threaded or sweat connection, stainless steel stem, stainless steel, or aluminum bronze conventional ported ball, teflon or silicone bronze seat, steel lever handle, indicator stop, 150 lb. 600 WOG.
b. Valves installed in insulated piping to have extended handles to clear insulation. Stem extension shall be made of a non-thermal conducting material with a sleeve to form an insulated vapor seal after the valve is insulated. Based on Nibco T-580-70.

C. Check Valves:
1. Potable Water Service:
a. Horizontal swing check valve:
i. Size 1/4 inch thru 3 inch. Bronze body thread or sweat connection, "Y" pattern, bronze seat, renewable teflon or bronze swing disc, Class 125. Based on Nibco T-413-B, Y or S-413-B, Y.
ii. Size 4 inches and up. Bronze body, sweat connection, bolted cover, bronze seat,

bronze disc holder. Renewable bronze disc, Class 125. Based on Nibco Fig. S-433.

b. Vertical lift check valve.

i. Size 3/8 inch thru 2 inches. Bronze body threaded or sweat connection, renewable teflon disc and seat, copper or stainless steel, spring loaded, stainless steel guide pin Class 125. Based on Nibco S-480 or T-480.

ii. Size 2-1/2 inches thru 10 inches. Iron wafer type body, taped lug connection, renewable bronze disc and seat, stainless steel spring loaded, bronze guide pin, Class 125. Based on Nibco W-910.

iii. Size 12 inches and up. Bronze globe body, flanged connection, renewable bronze disc and seat, stainless steel spring loaded, bronze guide pin, Class 125. Based on Nibco F- 910.

D. Combination Automatic Flow Control and Shutoff Valves:

1. Water Service:

a. Size 1/2 inch thru 2 inches: Brass wye body thread or sweat connection, union, two-temperature and pressure test port extended to clear require insulation, brass or bronze ball valve with stainless steel ball and stem, non-thermal conductive material type actuator extended to clear required insulation for chilled water applications, steel lever type for heating applications. Range 20-degrees F to 230-degrees F rating 400 psi water. Stainless steel or nickel-plated piston brass orifice and spring, replaceable without removing from installation, factory set to control the flow rate within 5% of the tagged rating over an operating pressure differential of at least 10 times the minimum required for full flow condition. GPM and direction of flow shall be clearly marked on flow control valves. Wide open pressure drop shall not exceed 10 feet. Valves shall be calibrated for the fluid being pumped. Based on Flow Design, Inc. AutoFlow Model AC.

E. Drain valves:

1. Potable water service:

a. Size 1/2 inch and 3/4 inch. Two-piece, adapter loaded, single reduced port type with brass body, iron pipe thread inlet or sweat inlet, 3/4 inch hose thread outlet, brass cap and chain at outlet, stainless steel stem, stainless steel ball, teflon or silicone bronze seat, steel lever handle, indicator stop, 150 lb. 600 WOG.

b. Valves installed in insulated piping to have extended handles to clear insulation. Based on Watts B-6000-CC or B-6001-CC or Nibco T-585-70HC.

PART 3 - EXECUTION

3.1 GENERAL

A. Provide shut-off valves on the inlet and outlet of each piece of equipment at the take-off of each major branch from a header and at the base of each pipe riser in order to facilitate service.

B. Provide drain valves at the base of each pipe riser and at each piece of equipment to facilitate service.

C. Provide locking device on handle of the expansion tank isolation valve to prevent accidental closing.

3.2 INSTALLATION

A. Automatic Flow Control Valves:

1. Install with taps in upright or vertical position.

2. Tag valve for:

a. Type of service.

b. Flow in GPM.

3. The contractor shall assume the responsibility to obtain the necessary gauges and thermometers to properly take the differential pressure and temperature readings from the flow control valves.
4. All flows shall be verified.

B. Ball Valves:
1. Install valves with adequate access to lever actuator.
2. Provide adequate space for actuator handle in the open and closed position and for packing replacement.

C. Check Valves:
1. Horizontal swing check valves: Install valve with swing disc in the pendent position, cover in upright position.
2. Vertical lift check valve:
a. Install valve in vertical position, upward flow.
b. Flanged valves will be installed between 125# or 150 ANSI flanges or other flanged valves.
c. A spool piece a minimum of 6 inch face to face will be used to separate a vertical lift check valve and a butterfly valve.
d. Inspect the face of the flange and valve for casting/matching burrs. If burrs exist remove by draw filling prior to gasket placement.

D. Combination Flow Control and Shutoff Valves:
1. Install with taps in upright position in a manner that will allow all the tap to be used as an air vent.
2. Tag valve for:
a. Type of service.
b. Flow in GPM.
3. Obtain the necessary gauges and thermometers to properly take the differential pressure and temperature readings from the flow control valve.
4. All flows shall be verified.

E. Drain Valves: Install valves to provide adequate space for hand wheel, access, stem travel, disc replacement cap removal and clearance for easy hose connection without crimping hose.

F. Lubricated Plug Cock: Install valve with actuator in the upright or horizontal position.

END OF SECTION

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SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

B. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Inserts, Shells and Upper Attachments.

B. Pipe Hangers, Rods, Supports and Accessories.

C. Pipe Sleeves.

D. Pipe Seals.

E. Fabricated Steel Support.

1.3 QUALITY ASSURANCE

A. Design of pipe supporting elements shall be in accordance with ANSI B31.1.

B. Fabrication and installation of pipe hangers and supports shall be in accordance with the following Manufacturers Standardization Society (MSS) Standards.

1. SP-58 Pipe Hangers and Supports: Materials, Design and Manufacture.
2. SP-69 Pipe Hangers and Supports: Selection and Application.
3. SP-89 Pipe Hangers and Supports: Fabrication and Installation Practices.

C. Steel angles, channels and plate shall be in accordance with ASTM A36, red primed or hot dipped galvanized for interior applications, and hot galvanized for exterior applications.

D. Bolts, including nuts and washers, used for fabricating steel members shall be in accordance with ASTM A325 and shall be stainless steel or plated for corrosion protection. Plain steel components are unacceptable.

E. Welding of steel members shall be in accordance with AWS D1.1.

F. Steel supports for pipe anchors, pipe guides, and piping supported from below shall be fabricated in accordance with AISC Specification for the Design, Fabrication and Erection of Structural Steel for buildings. If required, the contractor shall include the cost of the services of a structural engineer to design or review the system.

1.4 APPLICABLE PUBLICATIONS

A. Applicable sections of the publications listed below form a part of this section. The publications are referenced to in the text by the basic designation only.

1. American Institute of Steel Construction (AISC)
2. American National Standards Institute (ANSI)
3. American Society for Testing and Materials (ASTM)
4. American Welding Society (AWS)
5. The Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS)
6. National Fire Protection Association (NFPA)
7. Sheet Metal and Air Conditioning Contractor's National Association, Inc. (SMACNA).

1.5 SUBMITTALS

A. Submit schedule indicating type of hanger to be used by system and pipe size. Include rod size for each hanger size.

B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

C. Refer to Division 1 for submittal requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Inserts, Shells and Upper Attachments:

1. Anvil International, Inc.
2. Carpenter Paterson, Inc.
3. Cooper B-Line®, Inc.
4. Elcen Metal Products
5. Hilti
6. Michigan Hanger Company
7. PHD Manufacturing, Inc.
8. Unistrut®

B. Pipe Hangers, Rods, Supports and Accessories:

1. Anvil International, Inc.
2. Carpenter Paterson, Inc.
3. Cooper B-Line®, Inc.
4. Elcen Metal Products
5. Hilti
6. Michigan Hanger Company
7. PHD Manufacturing, Inc.
8. Unistrut®

C. Pipe Sleeves:

1. Metraflex – Metraseal
2. Thunderline Corporation - Link Seal
3. Approved Equal.

D. Pipe Seals:

1. Metraflex – Metraseal
2. Thunderline Corporation - Link Seal
3. Approved Equal.

E. Fabricated Steel Support: As Detailed on Drawings.

2.2 FABRICATION

A. Inserts, Shells and Upper Attachments:

1. Inserts; MSS Type 18; malleable iron body and nut, galvanized finish, opening in top of insert for reinforcing rod, lateral adjustable. Rated for 1,140 lbs. Based on Anvil Fig. 282.
2. Shells: Steel shell and expander plug, snap off end fastener. Based on Phillips Concrete Fasteners Red Head.

3. Upper Attachments:
    a. Top beam clamps; MSS Type 19: Malleable iron galvanized finish clamp, hardened steel cup point set screw and locknut. Rating is contingent on rod and bolt size. Based on Anvil Fig. 94.
    b. Bottom Beam Clamp; MSS Type 23: Malleable iron galvanized finish clamp, hardened steel cup point set screw and locknut, and retaining clip. Rating is contingent on rod and bolt size. Based on Anvil Fig. 86 Clamp and Fig. 89 Retaining Clip (or Fig. 87).
    c. Welded Beam Attachment; MSS Type 22: Carbon steel suitable for eye rod or rod and locknut, rating is contingent on rod and bolt size. Based on Anvil Fig. 66.
    d. Center Beam Clamp; MSS Type 21: Malleable iron jaw and square head bolt and nut with galvanized finish. Rating is contingent on rod and bolt size. Based on Anvil Fig. 134.
    e. Center Beam clamp; MSS Type 29: Forged steel, weldless eye nut, tie rod to secure clamp to beam all with galvanized finish, rating is contingent on rod and bolt size. Based on Anvil Fig. 292 or 292L.

B. Pipe Hangers, Rods, Supports and Accessories:
1. Pipe Hangers:
    a. Clevis Hanger; MSS Type 1: Carbon steel, galvanized for interior and exterior use, sized to accommodate required insulation. Rating is contingent on rod and bolt size. Based on Anvil Fig. 260 or 300.
    b. Pipe Rings; MSS Type 10: Carbon steel, galvanized for black steel and insulated pipe copper or copper plated or rubber coated for copper pipe. Threaded swivel sized to accommodate required insulation. Rating is contingent on rod and bolt size. Based on Anvil Fig. 69 or Fig. 97C for copper pipe.
    c. Adjustable Roller Hanger; MSS Type 43: Cast iron roll, carbon steel yoke rod roll and hex nut with galvanized finish. Sized to accommodate insulation. Rating is contingent on rod and bolt size. Based on Anvil Fig. 181.
2. Rods:
    a. Size 3/8" and up: All thread steel rod electro galvanized. Sizing for pipe or equipment support as follows:
    Copper Tube, Plastic Steel, Cast Iron or
    Fiberglass Reinforced, Glass

Pipe Size	Pipe Size	Rod Diameter	Maximum Equip Load
1/4" to 2”	1/4" to 2”	3/8"	730 lbs.
2-1/2" to 5”	2-1/2” to 3”	1/2"	1350 lbs.
6”	4” to 5”	5/8"	2160 lbs.
8” to 12”	6”	3/4"	3230 lbs.
14”	8” to 12”	7/8”	4480 lbs.
16”	14” to 16”	1”	5900 lbs.
18” to 20”	18” to 20”	1-1/4”	9500 lbs.
22” to 42”	22” to 42”	1-1/2”	13,800 lbs.

    b. Rods may be reduced one size for double rod hangers with 3/8” minimum diameter, or when other paragraphs require a minimum of 2 hangers per section provided the minimum diameter of 3/8” in maintained. Based on Anvil Fig. 146.

3. Supports:
    a. Pipe Saddle; MSS Type 38: Cast iron saddle, black steel lock nut nipple, cast iron reducer all with galvanized finish. Suitable for standard field cut and threaded galvanized steel pipe. Cast iron floor flange. Based on Anvil Fig. 264 Saddle, Fig. 63 Floor Flange.
    b. Pipe Saddle Cold Piping: MSS Type 40. Single bonded unit consisting of a galvanized metal shield and a molded section of rigid polyurethane foam insulation. Rigid urethane foam shall have a density of 4 pounds per cubic foot, a thermal conductivity of 0.13 Btu.in/sq.ft./hr.ºF at 75ºF mean temperature. Insulation thickness to be equal to thickness specified for pipe being supported.
    c. Adjustable Pipe Roll and Base; MSS Type 46: Cast iron base plate steel stand and roll, adjusting screws with galvanized finish. Based on Anvil Fig. 274.
    d. Welded Steel Bracket; MSS Type 32: Welded carbon steel rate for 1500 lbs., with galvanized finish. Rating is contingent on rod and bolt size. Based on Anvil Fig. 195.
    e. Riser Clamps; MSS Type 8: Carbon steel, galvanized finish for black steel or galvanized pipe, plastic coated for cold steel, copper, glass or brass pipe rated for a minimum of 220 lbs. at 3/4" size. Based on Anvil Fig. 261.
4. Accessories:
    a. Protective Shields; MSS Type 40: Carbon steel, galvanized minimum of 12" length sized for required insulation. Based on Anvil Fig. 167.
    b. Protective Saddles; MSS Type 39: Carbon steel plate, minimum of 12" length, sized for required insulation. Based on Anvil Fig. 160 thru 165.
    c. Steel Turnbuckle; MSS Type 13: Forged steel, galvanized finish with locknuts. Rated at a minimum of 730 lbs. at 3/8" size. Based on Anvil Fig. 230.
    d. Steel Clevis; MSS Type 14: Forged steel, galvanized finish with steel pin and cotter pin. Rated for a minimum of 730 lbs. at 3/8" size. Based on Anvil Fig. 299.
    e. Weldless Eye Nut; MSS Type 17: Forged steel, galvanized finish. Rated for a minimum of 730 lbs. at 3/8" size. Based on Anvil Fig. 290 or 290L.

C. Pipe Sleeves:
1. Wall: Schedule 40 carbon steel pipe sized to accommodate pipe. If sleeves are field cut, coat cut edges with cold galvanizing spray, ZRC or equivalent.
2. Floor or Exterior Walls below Grade: Schedule 40 steel pipe with anchor and water stop hot dip galvanized after fabrication. Sized to accommodate pipe. Sleeve length will be sized to allow a minimum of 1/2" extension below floor or exterior side of a wall below grade and 1-1/2" extension above floor and 1/2" extension on interior side of an exterior wall below grade.
3. Roof: All penetrations of roof to be in accordance with requirements of Division 7 - Thermal and Moisture Protection.
4. Based on Thunderline Corp. Link Seal Wall Sleeve.

D. Pipe Seals: Composition Plastic Pressure Plates, zinc coated bolts, nuts and metal parts, composition rubber sealing element designed for long term stability rated for temperatures of 40-degrees F to +250-degrees F. Based on Thunderline Corp. Link Seal LS Series.

E. Fabricated Steel Supports:
1. Field or shop fabricated. See details on drawings.
2. If not detailed on drawings the contractor is to provide suitable support as required.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Where applicable install in accordance with the manufacturers' written installation instructions.

B. Where supports are in contact with copper pipes provide copper plated support or wrap pipe with sheet lead.

C. Where supports are in contact with glass, aluminum or brass pipe provide plastic coating on supports, or wrap pipe with sheet plastic.

D. General interior support, including attachments and pipe supports that are plain steel shall be cleaned of all rust, primed and painted black within one week of installation. At substantial completion all supports shall be free of rust and in a "like new condition".

E. Hangers and support, including attachments & pipe support, exposed to weather or located in utility tunnels or accessible utility trenches or subject to spillage shall be hot dip galvanized after fabrication. At substantial completion all supports shall be free of rust and in a "like new condition".

F. Fabricated steel supports exposed to weather (including pipe supports) or located in utility tunnels and accessible utility trenches or subject to spillage shall be hot dipped galvanized after fabrication, primed and painted black within one week of installation. Cut, welded, drilled, or otherwise damaged surfaces of galvanized coating shall be repaired in accordance with Section 22 02 00. At substantial completion all supports shall be free of rust and in a "like new condition".

3.2 INSTALLATION

A. Inserts, Shells and Upper Attachments:

1. Inserts:
    a. Contractor shall have inserts at site and dimensioned location drawings ready at the beginning of the involved concrete work.
    b. Install inserts by securing to concrete forms and inserting reinforcing rod thru the opening provided in the insert in accordance with shop drawings.
    c. Provide necessary supervision while concrete is being poured to correct any misalignment caused by the concrete.
2. Shells: Size shell length to assure a minimum of 1" solid concrete remaining from shell end to concrete face.
3. Upper Attachment:
    a. Select proper attachment for building construction.
    b. For plain steel devices, prime with black paint prior to installation.
    c. Adjust attachment location for proper alignment and no more than 4 deg. offset from a perpendicular alignment.
    d. If proper alignment cannot be achieved from the existing building structure provide a trapeze type support size to handle the design load with a minimum safety factor of 5.

B. Pipe Hanger, Rods, Supports and Accessories:

1. Select proper hanger for piping systems.
2. The location of hangers and supports shall be coordinated with the structural work to ensure that the structural members will support the intended load.
3. Provide hex head nut on rod at top and bottom of clevis hanger yoke, and at each rod connection to intermediate and upper attachment. Rod nuts shall be securely locked in place.

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4. Hanger rods shall be subject to tensile loading only. Where lateral or axial movement is anticipated, use suitable linkage in hanger rod to permit swing.
5. Hangers shall be fabricated to permit adequate adjustment after erection while still supporting the load. Turnbuckles shall be provided where required for vertical adjustment of the piping.
6. Supports for vertical piping shall be located at each floor or at intervals of not more than 15 feet and at intervals of not more than 8 feet from end of risers. Where supports are provided on intermediate floors spaced 15 feet or less between floors, no additional supports are required other than those specified for end of risers.
7. A hanger or support shall be provided adjacent to each piece of equipment to ensure that none of the pipe weight is supported from the equipment.
8. The maximum spacing between pipe supports for straight runs shall be in accordance with the following chart. If any deviation from the table exists within the manufacturers written installation instructions, whichever spacing reflecting the smaller centerline to centerline dimension shall be used.
   Maximum Horizontal Pipe Hanger and Support Spacing Table:

Material	Size	Maximum Spacing of Supports
Steel Pipe (Schedule 40 & 80)	Up to 1":	7 ft. on center
	1-1/4" and greater	10 ft. on center
Copper Pipe (Types L, K and M)	Up to 1-1/4" size	5 ft. on center
	1-1/2" to 2-1/2":	6 ft. on center
	3" and larger	10 ft. on center
Ductile Iron and Cast Iron	Two hangers per section length	
Polyvinyl Chloride (PVC)		3 ft. on center
		4 ft. on center

9. Hanger centerline spacing shall be reduced by 50% in areas of concentrated valves and/or fittings, also no more than a maximum distance of 12 inches from valves, fittings and/or couplings, or 24 inches from a change in direction.
10. Parallel piping may be supported by trapeze hangers consisting of steel angle, channel, or beam suspended by steel rods attached to upper structure. Piping may be supported above, or suspended below, the angle, channel, or beam.
11. Provide protective shields on all cold and dual temperature piping required to be insulated.
12. Provide protective saddles sized to match insulation thickness on all hot piping required to be insulated. Fill void between saddle and pipe with insulation as specified.
13. Provide turnbuckles on all hangers which require leveling or aligning.
14. Provide steel clevis where detailed and/or required.
15. Provide weldless eye nuts on hanger terminations where disassembly or swing may be required. Use in combination with steel clevis.

C. Pipe Sleeves:

1. Secure sleeves to forms for concrete construction. Ensure sleeves are not disengaged or misaligned by concrete placement operations.
2. Provide temporary cap for open end of sleeves to prevent entrance of concrete.
3. Provide temporary internal bracing where required to prevent distortion of sheet metal sleeves by concrete placement operations.
4. Sleeves shall not be installed in structural members, except where indicated or approved.

5. Furnish sleeves to masonry contractor in advance of masonry work. Furnish dimensioned drawings indicating exact location of sleeves.
6. Each sleeve shall extend through its respective wall, floor, or roof, and shall be cut flush with each surface, except as indicated otherwise.
7. Sleeves passing through floors in wet areas, such as areas containing plumbing fixtures or floor drains, shall extend a minimum of 4 inches above the finished floor. Sleeves in wet areas shall be enclosed with 4-inch concrete curb.
8. Unless otherwise indicated, sleeves shall be of a size to provide a minimum of 1/4 inch clearance all around between the pipe and inside of sleeve, or between jacket over insulation and sleeve.
9. Provide membrane clamping devices on sleeves for waterproof floors.
10. Sleeves are not required in existing structures where openings through existing concrete floors, walls, or roof are core drilled.

D. Pipe Seals:
   1. Provide pipe seals for all pipe sleeves used in:
      a. External walls.
      b. Floor slabs on grade.
      c. Upper floors where spillage may occur.

E. Fabricated Steel Supports: Steel for supports shall be sawcut, with sharp edges ground smooth. After fabrication remove all foreign material, including welding slag and spatter, and leave ready for painting or galvanizing, as applicable.

END OF SECTION

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SECTION 22 05 76 - FACILITY DRAINAGE PIPING CLEANOUTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

B. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Cleanouts.

1.3 SUBMITTALS

A. Submit shop drawings in accordance Division 1 for submittal requirements.

B. Each cleanout submittal must be marked to show what area it will be used.

1.4 JOB CONDITIONS

A. Provide protection for all cleanouts against damage during construction. The plumbing contractor shall be responsible to replace any damaged cleanouts.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. The manufacturers referenced herein are those that the specifications and drawings are based on. Equipment by other manufacturers will be considered provided all requirements and intent of the specifications are met.

2.2 MATERIALS

A. Cleanouts:

1. Floor Type (FCO):

a. Finished Floors - Cast iron adjustable floor level cleanout assembly with round nickel bronze top and plug, with inverted hub and neoprene gasket.

J. R. Smith Fig. 4033-L

Josam # 56010-22

MIFAB #C1100-R

Watts #CO-200-R

b. Terrazzo Floors - Cast iron adjustable floor level cleanout assembly with round nickel bronze top and plug, with center lifting device. Top depression to be filled with terrazzo and finished.

J. R. Smith Fig. 4180, Gasket #4193

Josam # 56040-13-1

MIFAB #C1100-UR

Watts #CO-200-LL

2. Above Floor (CO):

a. Caulk Ferrule Cleanouts - Cast iron ferrule with countersunk bronze plug.

J. R. Smith Fig. 4420

Josam # 58900

MIFAB #C-1450

Watts #CO-380

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3. Wall Type (WCO):
    a. Wall-Round Cover - Cast iron ferrule with lead seal plug, round stainless-steel cover with center screw.

        J. R. Smith Fig. 4402

        Josam # 58600-CO

        MIFAB #C1450-RD

        Watts #CO-380-RD

    b. Wall-Round Cover - Cast iron ferrule with lead seal plug; chrome plated bronze round frame and cover secured with slotted screws for "face-of-wall".

        J. R. Smith Fig. 4432

        Josam # 58610

        MIFAB #C1300-R

        Watts #CO-300-R

PART 3 - EXECUTION

3.1 INSTALLATION

A. Cleanouts:

1. Provide cleanouts in all locations shown on the drawings and in all other locations required by The Local Building Code, and as directed by the Local Inspector.
2. Where special conditions exist, such as the need for a shallow cleanout to meet invert elevations, make changes necessary at no change in contract price and submit drawings or description for approval if requested by the Architect.
3. Cleanouts shall be the same size as the pipes they serve up to 4 inch, and not less than 4 inch for piping of larger size.
4. Cleanouts shall be installed not more than 100 feet apart in horizontal drainage piping.
5. Cleanouts shall be installed in the horizontal piping at each change of direction of the building waste, soil and storm systems greater than 45-degrees.
6. A cleanout shall be installed at or near the base of each waste, soil or rainwater leader stack.
7. All work this section shall conform to local building/plumbing code.

END OF SECTION

SECTION 22 05 77 - FACILITY PLUMBING DRAINS AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

B. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Floor Drains.

B. Floor Sinks

C. Roof Drains

D. Trench Drains

E. Hub Drains.

F. Backwater Valve

G. Trap Primers

1.3 SUBMITTALS

A. Submit shop drawings in accordance with Division 1 Requirements.

B. Each drain submittal must be marked to show what area it will be used.

1.4 JOB CONDITIONS

A. Provide protection for all drains and cleanouts against damage during construction. The Plumbing Contractor shall be responsible to replace any damaged drains.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. The manufacturers referenced herein are those that the specifications and drawings are based on. Equipment by other manufacturers will be considered provided all requirements and intent of the specifications are met.

2.2 MATERIALS

A. Floor Drains:

1. FD-1: Shower/Gym/Tiled areas s - Cast iron body, flashing clamp and adjustable square nickel bronze top and “P” trap with trap primer as required by governing authority.

   Zurn #ZN415-5S-P

   J. R. Smith Fig. 2010-B

   Josam #30000-S

   Watts #FD-100-M5-7

   MIFAB #F1100-C-S5-1

2. FD-2: Mechanical Room/Janitors closet Floor Drain - Cast iron body, flashing clamp and adjustable round nickel bronze top and “P” trap with trap primer as required by governing authority.

   Zurn #ZN415-5S-P

   JR Smith Fig. #2010-B

   Josam # 30000-S

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Watts #FD-100-M5-7

MIFAB #F100-C-S5-1

B. Floor Sinks:

1. FS-1: 12” x 12” x 8” cast iron body, square slotted medium duty grate, acid resistant porcelain enamel interior and top, complete with aluminum anti-splash interior bottom dome strainer. Coordinate grates and funnels with the Kitchen Consultant.

   Zurn #Z-1901

   Josam #49340A-LF

   Watts #FS-740

   MIFAB #FS1730

C. Roof Drains:

1. RD-1: Insulated Deck - Cast iron body, flashing, clamp and gravel stop, underdeck clamp, sump receiver, extension and low silhouette cast iron dome.

   Zurn #ZC100-DP-EA

   Josam #21000-22-3

   JR Smith #1015-CID-R-C

   Watts #RD-300-F-K40-D

   MIFAB #R1200-M

2. RD-2: Emergency Overflow Roof Drain: Insulated deck - cast iron body, flashing, clamp and gravel stop, under deck clamp, sump receiver, extension, and low silhouette cast iron dome. 2 inches internal water dam.

   Zurn #ZC100-DP-EA-89

   Josam #26000-22-3

   JR Smith #1074-CID-R-C

   Watts #RD-300-F-K40-D-W

   MIFAB #R1200-M-W2

D. Trench Drain:

1. TD-1: Pre-Sloped Trench Drain System with 6" wide x 48" long (standard) UV stabilized glass-filled polypropylene frame, UV stabilized talc-filled polypropylene channels with integral 4 inches No Hub bottom outlet(s). System shall be frame-anchored, with (specify) grating to suit DIN Class (specify) load rating. System to include frame connectors, grate lockdowns, and construction covers. Installation to be performed in accordance with manufacturer's instructions and building code. Install with stainless steel slotted cover.

   Watts Dead Level: P-PP-VR

   Zurn #Z-886-HPP-VP-JC-E1-U4

   Wsde: WN900-PSG-UEP-NH4-VR

E. Hub Drains:

1. HD-1: Cast iron body, flashing clamp, water dam, cast iron dome strainer with vandal-proof screws. Provide with deep seal "P" trap with trap guard.

   J. R. Smith Fig. 3960

   Josam # 25540

Watts #RD-200-R-LD-DS-L

MIFAB #R1100-RS

F. Backwater Valve:

1. BWV-1: Series coated cast iron backwater valve, offset type, bronze fixed swing-check assembly, bolted gasketed cover, and no-hub connections.

   Josam #67400

   Watts #BV-200

   MIFAB #BV1000

G. Trap Primer:

1. TPV-1: For floor drains. Mechanical trap primer. Install on a 1-1/2 inch or smaller line. Trap primer valve with a four outlet distribution system. Install per manufacturer's recommendations.
2. Precision Plumbing Products Oregon #1 Trap primer valve.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Drains:

1. Unless otherwise specified, drains to be complete with strainers, trim, flashing and appurtenances and constructed of cast iron with painted finish.
2. Set all floor drains level and at proper elevations to surrounding floor area to provide smooth and uniform drainage area.
3. Unless noted otherwise, provide a trap for each floor drain of a material to match the pipeline to which it discharges.
4. Provide drains in all locations shown on the Architectural and Plumbing drawings. Drains to be of the types specified herein and sized as shown on the plumbing drawings. Refer to the Architectural drawings for additional installation details.
5. Actual sizes and quantities of all drains shall be determined from the drawings.

END OF SECTION

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SECTION 22 07 00 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

B. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Piping Systems Insulation.

B. Accessories.

1.3 QUALITY ASSURANCE

A. All products within the conditioned air stream or active plenums shall comply with the NFPA 90A Flame/Smoke rating of 25/50 and comply with UL 181 erosion limitations. Fire hazard ratings shall be as determined by NFPA 255, "Method of Test of Surface Burning Characteristics of Building Materials" - ASTM E84 or UL 723.

B. All adhesives, cements, finishes, jackets, etc., shall be UL listed or labeled for use as applied to insulation and designed specifically for use in the installation.

C. All insulation shall be installed in accordance with National Commercial & Industrial Insulation Standards (NCIA).

1.4 SUBMITTALS

A. Submit schedule indicating type of insulation, thickness, vapor barrier or coating by system and size.

B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

C. Submit details of insulated removable covers using the actual equipment dimensions, concrete base sizes and piping arrangements.

D. Refer to Division 1 for submittal requirements.

1.5 GENERAL REQUIREMENTS

A. Factory-applied insulation is specified under the applicable equipment Section of these specifications. It is listed here for reference only.

B. Packages and standard containers of materials shall be delivered unopened to job site and shall have the manufacturer's label attached giving a complete description of the material.

C. All rain leader piping and roof drain bodies shall be insulated within the building to above grade. Materials are specified elsewhere herein.

1.6 DEFINITIONS

A. The term "exposed" means exposed to view in finished spaces, in equipment rooms, in fan rooms, in closets, in utility corridors, in tunnels, on roof, in storage rooms, and in other spaces as indicated.

B. The term "concealed" means concealed from view, and includes all spaces not defined as exposed.

C. The term "unconditioned" space shall mean all places where the temperature surrounding the pipe has not been conditioned consistent with conditioned spaces, and shall include mechanical equipment rooms, non-active ceiling plenums, and non-accessible chases. This term shall also include conditioned spaces where the humidity levels are allowed to rise above 70% RH.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Fiberglass Insulation:
   1. Owens-Corning Fiberglas
   2. Knauf Fiberglass
   3. CertainTeed
   4. Johns Manville

B. Closed Cell Elastomeric Insulation:
   1. Armacell LLC
   2. Johns Manville
   3. Rubatex

2.2 PIPE INSULATION REQUIREMENTS

	Thickness	Type
A. Condensate Drain (C):		
All Sizes	1/2"	Closed Cell Elast.
B. Dom. Cold Water (CW):		
Up to 4”		Not Required
5” through 14”		Not Required
C. Dom. Hot Water (HW) (HWR):		
Conditioned Space		
Up to 2”	1”	Rigid Fiberglass
2-1/2” through 4	1"	Rigid Fiberglass
5" through Larger	1-1/2”	Rigid Fiberglass
Unconditioned Space		
Up to 2”	1”	Rigid Fiberglass
2-1/2” through 4	1-1/2"	Rigid Fiberglass
5" through Larger	2"	Rigid Fiberglass
D. Hub Drains Receiving		
Condensate – All Sizes	1/2”	Closed Cell Elast.
Condensate - All Sizes	1/2"	Closed Cell Elast.
E. Storm water Drains		
All sizes	3/4"	Rigid Fiberglass

2.3 MATERIALS

A. Pipe Insulation (to 450-degrees F):
   1. Rigid Fiberglass: Resin bonded fibrous glass, flame retardant, factory applied all service jacket vapor barrier with self sealing pressure sensitive lap joints, molded to accommodate pipe, maximum vapor permeance of .02 perm/in. and a puncture resistance of 50 units, minimum density 4.0 lb./cf., maximum conductivity per 1 inch thickness of .23 at 75-degrees F, .29 at 200-degrees F and .43 at 400-degrees F mean temperature. Based on Knauf Pipe Insulation.
   2. Closed Cell Elastomeric (Small Pipe Sizes up to 5 Inches): Flexible, elastomeric, closed cellular, tubular molded to accommodate piping, smooth outer surface suitable for painting

with vinyl lacquer type coating, water resistant, nonabsorbent, ozone resistant, minimum density of 4 lb./cf., maximum conductivity per 1 inch thickness of .27 at 75-degrees F mean temperature. Based on Armacell LLC AP Armaflex and Self-seal Armaflex 2000.

3. Closed Cell Elastomeric (Large Pipe Sizes, 6 inches and Larger): Sheet type, flexible, elastomeric, closed cellular, smooth outer surface suitable for painting with vinyl lacquer type coating, water resistant, nonabsorbent, ozone resistant, minimum density of 4 lb./cf., maximum conductivity per 1 inch thickness of 2.7 at 75-degrees F mean temperature. Based on Armacell LLC Armaflex II.

B. Accessories:

1. Corner angles shall be minimum 28-gauge, 1 inch by 1 inch aluminum adhered to 2 inches by 2-inch heavy kraft paper.
2. Glass tape shall be a minimum density of 1.6 ounces per square yard, 4 inch wide with a 10 x 10 thread count per inch of width. Glass cloth shall be untreated.
3. Staples shall be outward clinching type, Type 304 or 316 stainless steel in accordance with ASTM A 167 or Monel® coated.
4. Wire shall be soft annealed galvanized, or copper, 16 gauge, or nickel copper alloy.
5. Closed cell elastomeric insulated finish shall be a white water based flexible, acrylic latex enamel equal to WB Armaflex finish.
6. Insulation Tape: Closed cell elastomeric insulation: 2 inches wide x 1/8 inch thick.
7. Elastomeric Insulation Adhesive: Air drying contact adhesive for securing sheets to flat or curved metal surfaces and joining seams and butt joints of elastomeric insulation. Suitable for temperatures to 180F, dried film not to exceed 25 for flame spread and 50 for smoke development when tested per ASTM E 84-84A method.
8. Vapor Barrier Mastic: Air drying flexible water-based mastic used for applying a vapor barrier joint with glass cloth at insulation joints. Suitable for temperatures to 180-degrees F, wet and dried film not to exceed 25 for flame spread and 50 for smoke development when tested per ASTM E 84-84A method. Maximum Perm rating of 0.08. , Childers Products Company, Inc. CP-35 Chil Therm® WB, Foster Products Corp. Product Data 30-80 Foster Vapor Safe® Coating, Marathon Industries, Inc. 590 LO-PERM, Richard’s Paint Manufacturing CO., Inc. VBM-4, Vimasco Corp. 749 Vapor-Blok, or equal.
9. Acrylic Latex Finish and Sealers:
    a. Elastomeric Insulations: Air drying flexible water-based finish used for finishing flexible elastomeric insulation. Suitable for temperatures to 180-degrees F, wet and dried film not to exceed 25 for flame spread and 50 for smoke development when tested per ASTM E 84-84A method. Armacell LLC WB Armaflex finish.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Install all insulation in strict accordance with the manufacturers’ written installation instructions.

B. All insulation work shall be performed by skilled mechanics regularly engaged in the insulation trade.

C. Properly coordinate the insulation work with the other trades so that installation is performed with a minimum of conflict.

D. Insulation shall not be applied on any piping system requiring testing until testing is completed and approved by Owner's Representative.

E. Insulation shall not be applied until all systems are clean, dry, free of dirt, dust or grease.

F. The finished installation shall present a neat and acceptable appearance which includes but is not limited to: all jackets smooth, all vapor barriers sealed properly, no evidence of "ballooning"

of the jackets, or sagging insulation, all valves, dampers, gauges, unions, etc. accessible. The Owner's Representative shall be the final judge of acceptance of workmanship.

G. All equipment nameplates on hot equipment shall be left uncovered. All equipment nameplates on cold equipment shall have a removable section sized to expose the nameplate. This section shall be clearly marked "NAMEPLATE".

H. If proper maintenance procedures require access to the insulated equipment removable panels, sections or covers shall be provided to accomplish this. These access devices shall be constructed in a manner to assure easy access and sturdy construction. The contractor shall assume the responsibility to coordinate all equipment requiring insulation to be either factory or field insulated.

I. Insulation and accessories shall be applied only at suitable application temperature and conditions as recommended by the manufacturer. Do not apply insulation to any surface while it is wet.

J. Insulation shall be protected from moisture and weather during storage and installation.

K. Insulation which has sustained moisture damage, torn jackets, or other damage due to improper storage or other reasons shall not be used. If evidence of this is sighted the Owner's representative reserves the right to require the insulating contractor to remove any and/or all insulation until the Owner's Representative is satisfied that there is no longer any inferior insulation installed on this project.

L. Insulation, fabric and jacketing shall be protected from damage during construction. Damage by the insulator shall be repaired without cost to the Owner. Damage by others shall be reported in writing to the contractor.

M. The insulation subcontractor is responsible for proper material storage at the work site.

N. Work performed prior to receipt of approved documents or submittals, later proving to be incorrect or inappropriate, shall be promptly replaced by the contractor without cost to the purchaser.

O. Insulation shall not be installed until adequate access and clearances at control mechanisms, dampers, sleeves, columns and walls have been provided.

P. All insulation at handholes, access doors or other openings, and adjacent to flanges and valves shall be neatly finished where exposed to view.

Q. All materials, accessories and methods of installation and fabrication are subject to the Owner's Representatives inspection and approval during any phase of the work.

R. The insulation subcontractor shall prevent the accumulation of insulation debris in the buildings and on the premises of the Owner.

S. The insulation subcontractor shall be responsible for his own safety program at the work site and shall provide instruction on safe practices for his workers assigned to the project. All employees are subject to the work rules at the job site.

T. The insulation subcontractor shall familiarize himself with the progress and execution of the job and notify the proper parties of interference and any problems with the proper installation of his materials.

3.2 INSTALLATION

A. Pipe Insulation:

1. General:

a. All locations where the insulated surface is supported by hangers, the insulation shall be protected by shields or saddles properly skimmed to maintain a smooth outer surface, and proper insulation thickness. Chilled water piping, 3 inches and over shall have a section of foamglas insulation installed between the pipe and shield. 3 and 4 inches to be 12 inches long, 5 inches and 6 inches to be 18 inches long and 8 inches

and over, 24 inches long. If the possibility exists that the hanger may conduct the temperature of the conveyed medium and thus cause condensation or personal injury due to high temperature, the hanger shall also be insulated. Joints between foamglas and pipe insulation shall be properly sealed.

b. All devices connected to or in line with the piping system shall be insulated greater than or equal to the connecting piping. This includes but is not limited to valves, air separators, expansion tanks, control valves, control devices, gauge connections, thermometer stems, chemical feed equipment, piping flexible connectors, etc. This is particularly important on ice water and refrigerant lines.

c. The insulation at threaded unions in steam and hot water piping shall be tapered and terminated with cement and glass lagging cloth and lagging adhesives.

d. Insulate exterior surfaces of all anchors and guides for chilled water and dual temperature piping systems.

e. A complete moisture and vapor barrier shall be installed wherever insulation is penetrated by hangers or other projections through insulation and in contact with cold surfaces for which a vapor seal is specified.

f. Cover fittings, flanges, unions, valves, anchors, and accessories with pre-molded or segmented insulation of the same thickness and material as the adjoining pipe insulation. Where nesting size insulation is used overlap pipe insulation 2 inches or one pipe diameter. Fill voids with insulating cement and trowel smooth. Elbows shall have not less than 3 segments per elbow. Secure insulation with wire or tape until finish is applied. Blanket inserts in lieu of pre-molded or segmented insulation is not allowed. Cover fittings with preformed PVC fitting covers.

g. Wrap all pressure gauge taps, thermometer wells and all other penetrations through insulation with closed cell insulation tape so as to prevent condensation.

h. Seal all raw edges of insulation.

i. For piping supported by hangers outdoors, apply a rain-shield to prevent water entry.

2. Rigid Fiberglass:

a. Provide PVC fitting covers for all fittings.

b. Align all jacket seams.

c. Assure all vapor barriers are properly sealed.

d. Provide PVC jacket over all exposed insulation in the equipment room.

e. All corner angels below 6’-10” shall have padded insulation and be marked with yellow stripes.

3. Closed Cell Elastomeric:

a. All joints shall be sealed with adhesives.

b. Where the thickness is to be obtained by use of two layers of insulation, install with staggered joints.

c. Finish:

i. Concealed Indoors: No additional finish.

ii. Exposed Indoors: Provide a PVC jacket over all insulation.

iii. Concealed Indoors: Provide PVC jacket over fittings fabricated from insulation sections or sheet.

iv. Outdoors: Provide aluminum pipe jacket.

END OF SECTION

SECTION 22 11 16 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

B. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Domestic Water (CW/HW/HWR) Piping.

1.3 DEFINITIONS

A. The pipe sizes given in this document shall be construed nominal.

1.4 QUALITY ASSURANCE

A. All material provided under this section shall be standard catalogued products of recognized manufacturers regularly engaged in the production of such products, and shall be of the manufacturer's most recent design that is in regular production.

B. Each item provided under this section shall meet the requirements for that item as installed and used, in accordance with the following standards:

1. Metallic Piping Systems employing mechanical joints and grooved-end pipe - ASME/ANSI B-31.9
2. All other metallic piping - ASME/ANSI B31.1

C. Each piping system shall be in accordance with the system design pressures shown in paragraph 2.1 - Materials, this specification section.

D. All materials provided under this section shall be new, except where the specifications and/or drawings permit the reuse of certain existing materials.

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this Section to the extent referenced. The publications are referenced in the text by the basic designation only.

B. The work and materials listed in this Section shall be provided in accordance with the standards and requirements set forth in the applicable portions of the latest editions of the referenced publications.

C. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.

1. American National Standards Institute (ANSI) Standards
2. American Petroleum Institute (API) Specification
3. American Society of Mechanical Engineers (ASME) Publications
4. American Society for Testing and Materials (ASTM) Publications
5. American Welding Society (AWS) Publication
6. American Water Works Association (AWWA) Standards
7. Cast Iron Soil Pipe Institute (CISPI) Standards
8. The Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS) Publications
9. National Fire Protection Association (NFPA) Standards
10. National Sanitation Foundation (NSF) Testing Laboratory Standards.
11. Plastic Pipe Institute (PPI) Manual.

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12. Plumbing and Drainage Institute.
13. Underwriters Laboratories (UL).

1.6 SUBMITTALS

A. All submittals shall be made in accordance with Division 1 Requirements.

B. Submit a list identifying the specific type of material that will be used for each piping system. Include pipe, pipefittings, valves and joints. Include the basic designation of the publication applicable for each type of material and method.

C. Submit current welder qualifications for all welders proposed for this project. Welding certificates shall be for the company performing the welding at this project as directed in Paragraph 3.2 - WELDING, BRAZING, AND SOLDERING.

D. Submit certified welding inspection reports as directed in Paragraph 3.2 - WELDING, BRAZING, AND SOLDERING.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Domestic (Potable) Water (CW/HW/HWR) Piping System Design Pressure: 150 psig.

1. Piping, 8 inches and smaller - Above grade, copper tube, Type “L”, hard temper, ASTM B88. Wrought cooper or bronze fittings, solder joint, pressure rated, ASTM B16.22-95; or cast bronze fittings, solder joint, pressure rated, ASME B16.18-R94.
2. Piping, 4” and smaller – Below grade, copper tube, Type “K”, hard temper, ASTM B88. Wrought copper or bronze fittings, solder joint, pressure rated, ASTM B16.22-95; or cast bronze fittings, solder joint, pressure rated, ASME B16.18-R94.
3. Water main pipe and fittings, piping 5 inches and larger:
    a. Ductile iron pressure pipe, bell and spigot or mechanical joint, Class 51, 150 psi working pressure, ANSI Standard A21.51. Ductile iron fittings, ANSI Standard A21.11. Include cement mortar lining, ANSI Standard A21.4.
    b. PVC – ASTM D1784, D1785, SDR 18; fittings PVC-ASTM D2466; joints solvent D2564 or ASTM D1869 ring gasket; NSF Standard 14 & 61.
4. One-half inch trap primer wastewater feed line to floor drains, same as domestic water, Type “L”, except soft-drawn copper.
5. Temperature and pressure relief lines and drain pan lines same as domestic water, Type “L” hard-drawn copper in a return air plenum.
6. Piping above slab/grade pipe, size 1/2” to 2-1/2” may be Type “L” ASTM B-88 copper tubing.
7. Pipe Fittings, 4 inches and smaller - Below ground installation: Wrought Copper, ANSI B16.22.
8. Pipe fittings, 5 inches and larger - Below ground installation: Ductile Iron, Class 150, Cement mortar lined, with mechanical joint and/or plain ends as required. The fitting mechanical joints shall match the joints of the pipe and shall be in accordance with ANSI/AWWA C111/A21.11.
9. Solder for factory fabricated fittings: Lead-free per FPC.
10. Brazing for Mechanically formed tee fittings: Brazing may be:
    a. 5% silver, 6% phosphorus, balance copper, 1190-degrees F melting point. AWS A5.8 number BcuP -3. J.W. Harris Stay-Silv® 5 or equal.
    b. 15% silver, 5% phosphorus, balance copper, 1190-degrees F melting point. AWS 5.8 number BCuP-5. J.W. Harris Stay-Silv® 15 or equal.

c. 6% silver, 6.1% phosphorus, balance copper, 1190-degrees F melting point. QQ-B-654A number BcuP -5. J.W. Harris Dynaflow® 5 or equal

11. Bolts for ductile iron mechanical joints shall be square-headed, carbon steel, ASTM A-307, Grade B. Nuts shall be heavy-duty hex type full nuts; ASTM A-194, Grade 2.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Furnish and install piping, fittings and appurtenances required to complete the piping systems shown on the drawings. Elbows shall be long radius type. Tees may not be field fabricated.
2. Run piping to true alignment, generally parallel or perpendicular to building walls, floors and ceilings, and with uniform grades and spacing, so as to present a neat and workmanlike appearance.
3. Care shall be paid to the exact locations of piping with respect to equipment, ducts, conduits, slabs, beams, lighting fixtures, columns, ceiling suspension systems, etc. to provide maximum access to mechanical and electrical equipment in the building. Close coordination and cooperation shall be exercised with other trades in locating the piping in the best interests of the Owner. The drawings and specifications covering other work to be done in the building shall be carefully studied and arrangements made to avoid conflict.
4. Not all necessary pipe offsets are indicated on the drawings because of the small scale. The various runs of piping to be installed shall be studied and adjustments made in exact routings as may be required for proper installation.
5. Conflicts arising during the erection of piping shall be brought to the attention of the Owner's Representative. No improvising or field changes will be permitted without the approval of the Owner's Representative.
6. Use full lengths of pipe wherever possible. Short lengths of pipe with couplings will not be permitted. Cut to exact measurement and install without forcing or spring unless otherwise shown on the drawings or specified.
7. Avoid tool marks and unnecessary pipe threads. Burrs formed when cutting pipe shall be removed by reaming. Before installing any pipe, care shall be taken that the inside is thoroughly cleaned and free of cuttings and foreign matter. Measures shall be taken to preserve this cleanliness after erection.
8. Arrange pipe connections to valves and specialties so that there is clearance for easy removal of the valve or specialty from the line, and also for the removal of the valve bonnet and interior, and the specialty top and bottom and interior, except where otherwise approved by the Owner's Representative.
9. Erect piping in such a manner so as to obtain sufficient flexibility and to prevent excessive stresses in materials and excessive bending movements at joints or connections to equipment. Make allowances throughout for expansion and contraction of piping. Provide each riser and horizontal run of piping with expansion loops, expansion joints, or expansion compensators where indicated and required.
   Securely anchor and adequately guide pipe as required or where indicated to force expansion to the expansion device without bending, binding, or misalignment of pipe. Branch connections from mains to risers shall be made with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Where indicated, in lieu of expansion loops, expansion joints, or expansion compensators, horizontal runs of pipe shall be anchored at approximately midway of the run to force expansion, evenly divided, toward the mains and risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that piping will spring enough to allow for expansion without straining.

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10. Installed piping shall not interfere with the operations or accessibility of doors or windows and shall not encroach on aisles, passageways and equipment, and shall not interfere with the servicing or maintenance of any equipment. Adjacent pipelines shall be grouped in the same horizontal or vertical plane.
11. Where lines are purposely pitched for drainage, an accurate grade shall be maintained. No lines shall be supported in such a manner as to permit deflection, due to gravity, sufficient to pocket the lines when full of liquid. Grade mains as indicated by arrows on the drawings and in accordance with gradient as indicated in attached Piping Schedule.
12. Piping found to have water hammer or other objectionable vibrations which cannot be eliminated by proper grading or other natural means, shall be braced, trapped or hung with shock absorbing hangers and equipped with mechanical shock absorbers, flexible pipe connections or otherwise silenced using approved means.
13. Use building steel wherever possible for supporting pipe hangers. Main structural steel shall not be drilled, cut or burned for hangers without the approval of the Owner's Representative. Expansion bolts shall be used only upon the approval of the Owner's Representative.
14. Install unions or flanges in piping connections to equipment, regulating valves, and wherever necessary to facilitate the dismantling of piping and/or removal of valves and other items requiring maintenance.
15. Avoid bushings. Reducing fittings shall be used wherever practical.
16. The drawings indicate the size of piping and connections, and if certain sizes are omitted or unclear, obtain additional information before proceeding.
17. The piping drawings have been worked out with a view to the most economical installation, taking into consideration accessibility and appearances, and the Contractor must follow the drawings accurately and if it is found impractical to install the work in accordance with the drawings and specifications, the Contractor shall notify the Owner's Representative before making any changes and get their approval or revised drawings before proceeding with the work. Verify all measurements on the job before cutting pipes or having piping fabricated, and be responsible for the correct location of all pipe connections, also check sizes and standard of outlets on the equipment, including the dimensions and drilling of flanges, etc.
18. Copper tubing and galvanized steel shall not be mixed in any one run of piping.
19. Change in direction shall be made with fittings, except that bending of steel and copper pipe 4 inches and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. The centerline radius of bends shall be not less than 6 diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations is not acceptable.
20. Threaded joints shall be made with tapered threads in accordance with ANSI B2.1 and made tight with an approved pipe thread joint compound or material, applied to the male threads only. Use compounds sparingly and apply with caution to ensure that compounds do not enter piping systems. When pipe joint is made up a maximum of 3 threads shall be visible.
21. Joints for plastic pipe shall be made in accordance with PPI Piping Manual.
22. Connections between ferrous and nonferrous metallic pipe shall be made with dielectric unions or flanges.
23. Connections between plastic and metallic pipe, between plastic and glass pipe, and between metallic and glass pipe, shall be made with transition fittings manufactured for the specific purpose.
24. Unions and flanges shall not be concealed in walls, partitions, or above inaccessible ceilings.

B. Plumbing Systems Additional Requirements:

1. Bends, plugs, or tees in water service lines, except soldered or screwed joints, shall be braced or clamped. The connection between the water service line and the domestic water distribution line shall be anchored by means of tie rods and pipe clamps.
2. Before connecting the domestic water system to underground supply connections, each supply connection shall be thoroughly flushed of all foreign matter.
3. Vertical cast iron soil pipe hubs inside buildings shall extend 6 inches above concrete slab-on-grade floors.
4. Provide test tees with screwed plugs in waste and vent systems to isolate sections of system previously tested from section of system under test. Distance between test tees on vertical lines shall not exceed static height allowable for system pressure limitations. All joints in test tees, including plugs, shall be tested under pressure as specified for system tests.
5. Joints between cast iron pipe and copper tube shall be made by using a brass-caulking ferrule and properly soldering the copper tube to the ferrule prior to pouring the lead.
6. Joints between cast iron and vitrified clay piping shall be made using either hot-poured bitumastic compound, or by a preformed elastomeric ring conforming to ASTM C564. The ring shall, after ramming, completely fill the annular space between the cast iron spigot and the vitrified clay hub.
7. Joints between copper tubing and threaded pipe shall be made by the use of brass adapters or dielectric fittings. The joint between the copper tubing and the fitting shall be soldered, and the connection between the threaded pipe and the fitting shall be a standard pipe size screw joint.
8. Joints between steel and cast-iron pipe shall be either caulked or threaded, or made with approved adapter fittings.
9. Install horizontal drainage piping in uniform alignment at uniform slopes that will produce a computed velocity of not less than 2 feet per second when flowing half full, or a minimum of 1/8" per ft. unless noted otherwise.
10. The underground water service pipe and the building sewer shall be not less than 10 feet apart horizontally, and shall be separated by undisturbed, or compacted, earth, unless the following requirements are satisfied:
    a. The water service pipe and the building sewer may be installed in the same trench, provided written approval is given by the plumbing official and the following conditions are met:
        i. The bottom of the water service pipe at all points shall be not less than 12 inches above the top of the sewer line at its highest point.
        ii. The water service pipe shall be placed on a solid shelf excavated at one side of the common trench.
        iii. The number of joints in the service pipe shall be kept to a minimum.
        iv. The materials and joints in the sewer pipe shall be installed in such manner, and shall possess the necessary strength and durability, to prevent the escape of solids, liquids, and gases there from under all known adverse conditions such as corrosion, strains due to temperature changes, settlements, vibration, and super-imposed loads.
        v. Where the water service line must cross the building sewer line, the bottom of the water service line within 10 feet of the point of crossing shall be at least 12 inches above the top of the sewer line. The sewer line shall be of cast iron, with leaded or mechanical joints, within 10 feet of the point of crossing.
        vi. Domestic water lines shall be disinfected.

11. Provide access panel for all valves located above non-accessible ceiling. Coordinate with Architectural plans for exact locations.
12. Provide clean-outs at the base of all sanitary waste and vent stacks.
13. When a PVC piping system is employed, the final rough-in piping shall transition to Type "L" copper tubing at penetration of wall construction to the fixture. The copper piping rough-in shall employ the usage of the "Hold Rite" support system to prevent movement of branch tubing. No exceptions.
14. Installation of copper tubing shall be per FPC, ASTM B32-96, and per Copper Development Association and ASTM B828-92-E01.
15. Install plugs or caps on all openings during the construction phase. The temporary plug shall be cap of same material as pipe. Duct tape is unacceptable for use as a plug for the construction phase.
16. All penetrations of piping through walls shall be made insect proof, (i.e., penetrations of waste arms, hot and cold-water piping through walls below sinks, lavatories, water closets, etc.). The escutcheon plate does constitute an "insect proof" closure.
17. Teflon tape shall be used on threaded connections. Expansion loops on hot water system shall be installed per manufacturer's instructions to suit temperature and pipe run.
18. Mechanically formed branch connections, commonly termed extruded outlets, shall be made in a continuous operation consisting of producing a pilot hole, drawing out the tube/pipe surface to form an outlet and facing of the outlet rim (including beveling when required). An integral pipe heating operation may be included, after the cutting of the pilot hole on Schedule 40 wall thickness. The outlet device shall be fully adjustable to insure proper tolerance and complete uniformity of the joint. Materials should have a minimum elongation of 20-25% to be acceptable for forming.
19. The extruded outlet and butt weld connection shall be in accordance with ASME Boiler and Pressure Vessel Code, as listed under ANSI B31 Standards.

C. Plastic Pipe Systems Additional Requirements:
   1. Joints between plastic pipe and other materials shall be subject to the following requirements:
      a. Joints between different grades of plastic pipe shall be made by use of an approved adapter fitting.
      b. Joints between the hub of cast-iron soil pipe and plastic pipe shall be made by use of a mechanical joint of the compression or mechanical sealing type.
      c. Joints between plastic pipe and cast-iron pipe, steel pipe, glass pipe, copper tube, and other piping materials shall be made by use of an approved adapter fitting.
   2. Plastic pipe, fittings, and solvent cement used for domestic hot and cold-water service shall bear the NSF seal for potable water.
   3. Plastic pipe, fittings, and solvent cement shall not be used in systems where temperature, and operating pressure plus system static head, exceeds materials temperature and pressure limitations.
   4. Plastic vent piping shall not pass-through roofs, firewalls, or fire partitions. Plastic waste and vent piping shall be installed in fire rated pipe chases when passing through floors or approved fire stop sleeve.

D. Mechanical Joint System Additional Requirements: Install in strict accordance with the manufacturer's written installation instructions.

3.2 WELDING, BRAZING, AND SOLDERING

A. Operator and Procedure Qualifications: All welding and/or brazing operators and all welding and brazing procedures shall be qualified in accordance with the requirements of Section IX of the ASME Boiler and Pressure Vessel Code.

B. Welding:

1. All pipe welding performed under this division of the specifications shall be examined in accordance with ANSI B31.1 requirement for each piping system. The pipe weld examination is hereby made a part of the work of this division of the specifications. An independent outside inspection firm, regularly performing this type of examination, shall be hired by the contractor or subcontractor performing the welding as part of the work of their contract. The examination shall be performed by a representative of the Inspection Company (hereafter called the Inspector) who is qualified and certified for each examination method required.
2. The Inspection Company performing the examination shall certify in writing that all pipe welds performed under this contract conform to the requirements of ANSI B31.1 for each piping system and to all other governing codes.
3. Before final acceptance of the welded piping, certified test reports shall be submitted for review. The reports shall include the following data: name and location of project, date of test, type of piping system, working pressure and temperature, standard used for testing and applicable test method, number and location of welds tested and names of persons performing test.
4. Welders and procedures for fire protection system piping qualified in accordance with NFPA 13.

C. Brazing: Silver braze joints in accordance with MSS-SP-73 "Silver Brazing Joints for Wrought and Cast Solder Joint Fittings".

D. Soldering: Joints in copper tubing shall be made with solder type fittings. Outside surface of the tube where engaged in the fitting, and inside surface of the fitting in contact with the tube, shall be cleaned with an abrasive material before soldering. Self-cleaning compounds shall not be used. Care shall be taken to prevent annealing of tube and fittings when making connections. The solder joint shall be made with flux and wire form solder, except brazed joints. The flux shall be a mildly corrosive liquid or a petroleum-based paste containing chlorides of zinc and ammonium. Solder shall be applied and drawn through the full fitting length. Excess solder shall be wiped from joint before solder hardens. Joints in copper tube sizes 2-1/2 inches and larger shall be made with heat applied uniformly around the entire circumference of the tube and fittings by a multi-flame torch. Use of oxyacetylene cutting torch in lieu of multi-flame torch is not permitted. Disassemble valves and other accessories that may be damaged by heat before soldering.

3.3 TESTING OF PIPING SYSTEMS:

A. Each piping system, after erection, shall be subjected to a pressure test. The test requirements shall be as follows:

1. Plumbing related systems shall be tested with water at not less than a 10 foot head. The water shall be kept in the systems for a period of not less than 15 minutes prior to start of visual examination. In lieu of water test, the systems may be tested with air at a uniform pressure of 5 psig, with no loss in pressure for a period of not less than 15 minutes.
2. Domestic Water Distribution Systems shall be tested with water at the system working pressure, but not less than 100 psig. Joints will be visually examined for leaks.
3. Domestic Water Service System shall be tested with water at 150 psig. Joints will be visually examined for leaks.

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4. Leaks, if any, shall be located, repaired, and retested in accordance with the test method specified for the system in which the leaks are located.

B. Prior to testing a system, the Contractor shall provide the proper Building Official and the Owner's Representative with not less than 24 hours notice of the proposed test. The Contractor shall obtain approval of the test results. Where written approval is required, the Contractor shall obtain such written approval, and submit a copy of the approval.

C. Work requiring testing shall not be covered, or otherwise concealed, until testing is completed, and approval is granted.

D. Work, or portions of work, that is altered in any way after testing and approval shall be retested, witnessed, and approval obtained.

E. Systems requiring hydrostatic tests shall be protected from damage caused by freezing. After tests are completed drain all sections of pipe, including traps, or fill undrained sections and traps with antifreeze solution. Vent all high points to release vacuum and ensure complete drainage of closed systems and blow out piping with compressed air to remove trapped water.

F. Duration of tests, unless specified otherwise, shall be the time required to examine each joint in the system being tested.

G. Systems requiring hydrostatic testing under pressure shall be vented at high points to ensure that all piping is completely filled with the testing medium.

H. Disconnect pressure boosting apparatus, or vacuum pumps, during the test time span specified for systems employing the pressure loss/time span test method.

I. During tests, isolate system components that have test pressures less than pressures specified for system tests.

J. Use clean soapy water applied to exterior of joints to locate leaks in systems using compressed air, dry carbon dioxide, or nitrogen, under positive pressure as a test medium.

3.4 CLEANING OF PIPING SYSTEMS

A. Plumbing piping systems shall be thoroughly cleaned as described in Section 22 11 17, “Disinfection of Domestic Water Lines”. The chlorination and disinfections process shall be witnessed by a representative of the owner and provide a written Certification, as such.

END OF SECTION

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SECTION 22 11 17 - DISINFECTION OF DOMESTIC WATER LINES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

B. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Provide personnel, equipment and supplies, disinfect domestic hot and cold-water systems, and flush out systems at completion of treatment.

1.3 DEFINITIONS

A. Disinfectant Residual means the quantity of disinfectant in treated water.

B. pH Factor means the measure of alkalinity and acidity in water.

C. ppm means parts per million.

1.4 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this Section to the extent referenced.

1. American Waterworks Association (AWWA) Standards.
2. Standard Methods for the Examination of Water & Wastewater (14th edition).

1.5 QUALITY ASSURANCE

A. Water Treatment Contractor: At least 5 years experience performing work specified herein.

B. Bacteriological Laboratory: State certification.

1.6 SUBMITTALS

A. General: Submit product literature for approval in accordance with Division 1.

B. Water Treatment Contractor's evidence of experience: Submit three (3) copies.

C. Bacteriological Laboratory's evidence of certification: Submit three (3) copies.

D. Test Reports: Submit four (4) copies as follows:

1. Disinfection Report, include:
    a. Date issued.
    b. Project name and location.
    c. Treatment Contractor's name, address, and phone number.
    d. Type and form of Disinfectant used.
    e. Time and date of Disinfectant injection start.
    f. Time and date of Disinfectant injection completion.
    g. Test locations.
    h. Initial and 24-hour Disinfectant Residuals in ppm for each outlet tested.
    i. Time and date of flushing start.
    j. Time and date of flushing completion.
    k. Disinfectant Residual after flushing in ppm for each outlet tested.
2. Bacteriological Report. Include:
    a. Date issued.
    b. Project name and location.

c. Laboratory's name, certification number, address, and phone number.

d. Time and date of water sample collection.

e. Name of person collecting samples.

f. Test locations.

g. Time and date of laboratory test start.

h. Coliform bacteria test results for each outlet tested.

i. Certification that water conforms or fails to conform to bacterial standards or fails to conform to bacterial standards of Federal Safe Drinking Water Act.

j. Bacteriologist's signature.

1.7 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Protect against damage and contamination.

B. Maintain caution labels on hazardous materials.

C. Maintain storage room dry and with temperatures as uniform as possible between 60°F and 80-degrees F.

D. Do not store Caustic Soda directly on floor colder than 55-degrees F.

1.8 PROTECTION

A. Provide necessary signs, barricades, and notices to prevent any person from accidentally consuming water or disturbing system being treated.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment shall conform to the respective publications and other requirements specified herein.

B. Disinfectant: Free chlorine; liquid, powder, tablet, or gas.

C. Alkali: Caustic Soda or Soda Ash.

D. Acid: Hydrochloric (Muriatic) type.

PART 3 - EXECUTION

3.1 INSPECTION

A. Prior to starting work verify that domestic water system is completed and cleaned.

B. Notify Contractor about defects requiring correction.

C. Do not start work until conditions are satisfactory.

3.2 PREPARATION OF WATER FOR TREATMENT

A. Verify pH factor of water to be treated.
B. If pH factor is less than 7.2, introduce sufficient Alkali during Disinfectant injection.
C. If pH factor is greater than 7.6, introduce sufficient Acid during Disinfectant injection.

3.3 SYSTEM TREATMENT

A. Injection Disinfectant throughout system to obtain 50 to 80 ppm residual.

B. Starting at outlet closest to water source, bleed water from each outlet until water produces odor of Disinfectant. Repeat process at each outlet throughout system. If odorless Disinfectant is used testing is required to determine if Disinfectant is fully dispersed throughout system.

C. Test for Disinfectant Residual at each of the following locations:

1. Ends of piping runs.

2. Remote outlets.

3. At least 15% of outlets on each floor where directed by Architect, but in no case less than 2 outlets.

D. Maintain Disinfectant in system for 24 hours.

E. If Disinfectant Residual is less than 25 ppm, repeat system treatment.

3.4 FLUSHING

A. Remove Disinfectant from system; permit no more than residual rate of incoming water or 1.0 ppm, whichever is greater.

3.5 BACTERIOLOGICAL TEST

A. Instruct Bacteriological Laboratory to take water samples no sooner than 24 hours after flushing system.

B. Take water samples at each of the following locations:

1. Where water enters system.
2. Ends of piping runs.
3. Remote outlets.
4. At least 10% of outlets on each floor other than those used for testing Disinfectant Residual, where directed by Architect, but in no case less than two (2) outlets.

C. Analyze water samples in accordance with AWWA Standard Methods for the Examination of Water & Wastewater, 14th edition.

D. If bacteriological test proves water quality to be unacceptable, repeat system treatment until water quality is acceptable.

END OF SECTION

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SECTION 22 13 16 - SANITARY DRAIN, WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

B. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Sanitary Drain, Waste and Vent (DWV).

1.3 DEFINITIONS

A. Pipe sizes given in this document are nominal.

1.4 QUALITY ASSURANCE

A. All material provided under this section shall be standard catalogued products of recognized manufacturers regularly engaged in the production of such products and shall be of the manufacturer's most recent design that is in regular production.

B. Each item provided under this section shall meet the requirements for that item as installed and used.

C. Each piping system shall be in accordance with the system design pressures shown in paragraph 2.1 - Materials, this specification section.

D. All materials provided under this section shall be new, except where the specifications and/or drawings permit the reuse of certain existing materials.

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this Section to the extent referenced. The publications are referenced in the text by the basic designation only.

B. The work and materials listed in this Section shall be provided in accordance with the standards and requirements set forth in the applicable portions of the latest editions of the referenced publications.

C. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.

1. American National Standards Institute (ANSI) Standards
2. American Petroleum Institute (API) Specification
3. American Society of Mechanical Engineers (ASME) Publications
4. American Society for Testing and Materials (ASTM) Publications
5. American Welding Society (AWS) Publication
6. American Water Works Association (AWWA) Standards
7. Cast Iron Soil Pipe Institute (CISPI) Standards
8. The Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS) Publications
9. National Fire Protection Association (NFPA) Standards
10. National Sanitation Foundation (NSF) Testing Laboratory Standards.
11. Plastic Pipe Institute (PPI) Manual.
12. Underwriters Laboratories (UL)

1.6 SUBMITTALS

A. All submittals shall be made in accordance with Division 1 requirements.

B. Submit a list identifying the specific type of material that will be used for each piping system. Include pipe, fittings, valves, hangers and supports. Include the designation of the publication applicable for each type of material and method.

C. Submit current welder qualifications for all welders proposed for this project. Welding certificates shall be for the company performing the welding at this project as directed in paragraph 3.2 - WELDING, BRAZING, AND SOLDERING.

D. Submit certified welding inspection reports as directed in paragraph 3.2 - WELDING, BRAZING, AND SOLDERING.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Sanitary Drain, Waste and Vent (DWV) Piping:

1. Underground sanitary piping:
    a. No-hub cast iron pipe and fittings, CISPI Standard 301, ASTM A-888-98el.
    b. No-hub couplings, CISPE Standard 310-97.
    c. Charlotte Seal Gaskets, ASTM C-564-97, CISPI-HSN.
    d. Warco-Quik-Tite Gaskets, ASTM C-564-94, CISPI-HSN.
    e. Schedule 40, PVC-DWV drainage pattern, conforming to the following standards:
        i. ASTM D-1784 – Rigid PVC Vinyl Components.
        ii. ASTM D-1785 – PVC Plastic Pipe, Schedule 40.
        iii. ASTM D-2665 – PVC Drain, Waste and Vent Pipe and Fittings.
        iv. ASTM D-2564 – Solvent Cements for PVC Pipe and Fittings.
        v. NSF Standard 14 – Plastic Piping Components and Related Materials.
    f. Pipe Size 15 inches - PVC pipe and fittings, ASTM D-3034 or ASTM F-679, SDR 35 gasket.
    g. Pipe Size 18 inches, 21 inches, 24 inches and 27 inches - PVC pipe and fittings, ASTM F-679, SDR 35 gasket.
    h. PP Schedule 40 polypropylene, ASTM D635 and ASTM F1412, drainage pattern, mechanical joint stainless-steel components, ASTM B117. Polypropylene shall be used where indicated on the drawings and as specified herein.
2. Above-ground sanitary and vent piping:
    a. No-hub cast iron pipe and fittings, CISPI Standard 301, ASTM A-888-98el.
    b. No-hub couplings, CISPI Standard 310.
    c. Charlotte Seal Gaskets, ASTM C-564, CISPI-HSN.
    d. Warco-Quik-Tite Gaskets, ASTM C-564-97, CISPI-HSN.
    e. 2” and smaller Type DWV hard-drawn copper tubing, ASTM B-306 with copper drainage pattern and (lead-free) solder 95-5 Tin-antimony.
    f. Schedule 40, PVC-DWV drainage pattern, conforming to the following standards:
        i. ASTM D-1784 - Rigid PVC Vinyl Components.
        ii. ASTM D-1785 - PVC Plastic Pipe, Schedule 40.
        iii. ASTM D-2665 - PVC Drain, Waste and Vent Pipe and Fittings.
        iv. ASTM D-2564 - Solvent Cements for PVC Pipe and Fittings.
        v. NSF Standard 14 - Plastic Piping Components and Related Materials.

3. 1/2 inch to 1 inch: Same as domestic water, Type “L” hard-drawn, or Schedule 40 PVC pipe and solvent joint fittings.
4. 1-1/4 inches to 2 inches copper drainage tube, DWV Kitchen (Kitchen sinks and equipment waste).
5. Soda conduits shall be long sweep PVC conduit ells (R=24 inches) with solvent joints.
6. Elevator sump pump discharge pipe, inside pit shall be Schedule 40 galvanized steel A53/A106 with black, cast iron drainage fittings with threaded joints. Discharge piping beyond elevator pit wall, below slab, to be similar to sanitary waste, Schedule 40 PVC-DWV.
7. PVC Foam core DWV pipe, ASTM F891, is not and shall not be approved under any circumstances nor installed on this project.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Furnish and install piping, fittings and appurtenances required to complete the piping systems shown on the drawings. Elbows shall be long radius type. Tees may not be field fabricated.
2. Run piping to true alignment, generally parallel or perpendicular to building walls, floors and ceilings, and with uniform grades and spacing, so as to present a neat and workmanlike appearance.
3. Care shall be paid to the exact locations of piping with respect to equipment, ducts, conduits, slabs, beams, lighting fixtures, columns, ceiling suspension systems, etc. to provide maximum access to mechanical and electrical equipment in the building. Close coordination and cooperation shall be exercised with other trades in locating the piping in the best interests of the Owner. The drawings and specifications covering other work to be done in the building shall be carefully studied and arrangements made to avoid conflict.
4. Not all necessary pipe offsets are indicated on the drawings because of the small scale. The various runs of piping to be installed shall be studied and adjustments made in exact routings as may be required for proper installation.
5. Conflicts arising during the erection of piping shall be brought to the attention of the Owner's Representative. No improvising or field changes will be permitted without the approval of the Owner's Representative.
6. Use full lengths of pipe wherever possible. Short lengths of pipe with couplings will not be permitted. Cut to exact measurement and install without forcing or spring unless otherwise shown on the drawings or specified.
7. Avoid tool marks and unnecessary pipe threads. Burrs formed when cutting pipe shall be removed by reaming. Before installing any pipe, care shall be taken that the inside is thoroughly cleaned and free of cuttings and foreign matter. Measures shall be taken to preserve this cleanliness after erection.
8. Arrange pipe connections to valves and specialties so that there is clearance for easy removal of the valve or specialty from the line, and also for the removal of the valve bonnet and interior, and the specialty top and bottom and interior, except where otherwise approved by the Owner's Representative.
9. Erect piping in such a manner so as to obtain sufficient flexibility and to prevent excessive stresses in materials and excessive bending movements at joints or connections to equipment. Make allowances throughout for expansion and contraction of piping. Provide each riser and horizontal run of piping with expansion loops, expansion joints, or expansion compensators where indicated and required. Securely anchor and adequately guide pipe as required or where indicated to force expansion to the expansion device without bending,

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binding, or misalignment of pipe. Branch connections from mains to risers shall be made with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Where indicated, in lieu of expansion loops, expansion joints, or expansion compensators, horizontal runs of pipe shall be anchored at approximately midway of the run to force expansion, evenly divided, toward the mains and risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that piping will spring enough to allow for expansion without straining.

10. Installed piping shall not interfere with the operations or accessibility of doors or windows and shall not encroach on aisles, passageways and equipment, and shall not interfere with the servicing or maintenance of any equipment. Adjacent pipelines shall be grouped in the same horizontal or vertical plane.
11. Where lines are purposely pitched for drainage, an accurate grade shall be maintained. No lines shall be supported in such a manner as to permit deflection, due to gravity, sufficient to pocket the lines when full of liquid. Grade mains as indicated by arrows on the drawings and in accordance with gradient as indicated in attached Piping Schedule.
12. Piping found to have water hammer or other objectionable vibrations which cannot be eliminated by proper grading or other natural means, shall be braced, trapped or hung with shock absorbing hangers.
13. Use building steel wherever possible for supporting pipe hangers. Main structural steel shall not be drilled, cut or burned for hangers without the approval of the Owner's Representative. Expansion bolts shall be used only upon the approval of the Owner's Representative.
14. Install unions or flanges in piping connections to equipment, regulating valves, and wherever necessary to facilitate the dismantling of piping and/or removal of valves and other items requiring maintenance.
15. Avoid bushings. Reducing fittings shall be used wherever practical.
16. The drawings indicate the size of piping and connections, and if certain sizes are omitted or unclear, obtain additional information before proceeding.
17. The piping drawings have been worked out with a view to the most economical installation, taking into consideration accessibility and appearances, and the Contractor must follow the drawings accurately and if it is found impractical to install the work in accordance with the drawings and specifications, the Contractor shall notify the Owner's Representative before making any changes and get their approval or revised drawings before proceeding with the work. Verify all measurements on the job before cutting pipes or having piping fabricated, and be responsible for the correct location of all pipe connections, also check sizes and standard of outlets on the equipment, including the dimensions and drilling of flanges, etc.
18. Copper tubing and galvanized steel shall not be mixed in any one run of piping.
19. Change in direction shall be made with fittings, except that bending of steel and copper pipe 4 inches and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. The center-line radius of bends shall be not less than 6 diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations is not acceptable.
20. Threaded joints shall be made with tapered threads in accordance with ANSI B2.1 and made tight with an approved pipe thread joint compound or material, applied to the male threads only. Use compounds sparingly and apply with caution to ensure that compounds do not enter piping systems. When pipe joint is made up a maximum of 3 threads shall be visible.
21. Joints for plastic pipe shall be made in accordance with PPI Piping Manual.
22. Connections between ferrous and nonferrous metallic pipe shall be made with dielectric unions or flanges.

23. Connections between plastic and metallic pipe, between plastic and glass pipe, and between metallic and glass pipe, shall be made with transition fittings manufactured for the specific purpose.
24. Unions and flanges shall not be concealed in walls, partitions, or above inaccessible ceilings.

B. Plumbing Systems Additional Requirements:

1. Bends, plugs, or tees in water service lines, except soldered or screwed joints, shall be braced or clamped. The connection between the water service line and the domestic water distribution line shall be anchored by means of tie rods and pipe clamps.
2. Before connecting the domestic water system to underground supply connections, each supply connection shall be thoroughly flushed of all foreign matter.
3. Vertical cast iron soil pipe hubs inside buildings shall extend 6 inches above concrete slab-on-grade floors.
4. Provide test tees with screwed plugs in waste and vent systems to isolate sections of system previously tested from section of system under test. Distance between test tees on vertical lines shall not exceed static height allowable for system pressure limitations. All joints in test tees, including plugs, shall be tested under pressure as specified for system tests.
5. Joints between cast iron pipe and copper tube shall be made by using a brass-caulking ferrule and properly soldering the copper tube to the ferrule prior to pouring the lead.
6. Joints between cast iron and vitrified clay piping shall be made using either hot poured bitumastic compound, or by a preformed elastomeric ring conforming to ASTM C564. The ring shall, after ramming, completely fill the annular space between the cast iron spigot and the vitrified clay hub.
7. Joints between copper tubing and threaded pipe shall be made by the use of brass adapters or dielectric fittings. The joint between the copper tubing and the fitting shall be soldered, and the connection between the threaded pipe and the fitting shall be a standard pipe size screw joint.
8. Joints between steel and cast-iron pipe shall be either caulked or threaded, or made with approved adapter fittings.
9. Install horizontal drainage piping in uniform alignment at uniform slopes that will produce a computed velocity of not less than 2 feet per second when flowing half full, or a minimum of 1/8 inch per ft. unless noted otherwise.
10. The underground water service pipe and the building sewer shall be not less than 10 feet apart horizontally, and shall be separated by undisturbed, or compacted, earth, unless the following requirements are satisfied:
    a. The water service pipe and the building sewer may be installed in the same trench, provided written approval is given by the plumbing official and the following conditions are met:
        i. The bottom of the water service pipe at all points shall be not less than 12 inches above the top of the sewer line at its highest point.
        ii. The water service pipe shall be placed on a solid shelf excavated at one side of the common trench.
        iii. The number of joints in the service pipe shall be kept to a minimum.
        iv. The materials and joints in the sewer pipe shall be installed in such manner, and shall possess the necessary strength and durability, to prevent the escape of solids, liquids, and gases there from under all known adverse conditions such as corrosion, strains due to temperature changes, settlements, vibration, and super-imposed loads.

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v. Where the water service line must cross the building sewer line, the bottom of the water service line within 10 feet of the point of crossing shall be at least 12 inches above the top of the sewer line. The sewer line shall be of cast iron, with leaded or mechanical joints, within 10 feet of the point of crossing.

11. Provide access panel for all valves located above non-accessible ceiling. Coordinate with Architectural plans for exact locations.
12. Provide clean-outs at the base of all sanitary waste and vent stacks.
13. Installation of copper tubing shall be per FPC, ASTM B32-96, and per Copper Development Association and ASTM B828-92-E01.
14. Install plugs or caps on all openings during the construction phase. The temporary plug shall be cap of same material as pipe. Duct tape is unacceptable for use as a plug for the construction phase.
15. All penetrations of piping through walls shall be made insect proof, (i.e., penetrations of waste arms, hot and cold-water piping through walls below sinks, lavatories, water closets, etc.). The escutcheon plate does constitute an “insect proof” closure.
16. Mechanically formed branch connections, commonly termed extruded outlets, shall be made in a continuous operation consisting of producing a pilot hole, drawing out the tube/pipe surface to form an outlet and facing of the outlet rim (including beveling when required). An integral pipe heating operation may be included, after the cutting of the pilot hole on Schedule 40 wall thickness. The outlet device shall be fully adjustable to ensure proper tolerance and complete uniformity of the joint. Materials should have a minimum elongation of 20-25% to be acceptable for forming.
17. The extruded outlet and butt weld connection shall be in accordance with ASME Boiler and Pressure Vessel Code, as listed under ANSI B31 Standards.

C. Plastic Pipe Systems Additional Requirements:

1. Joints between plastic pipe and other materials shall be subject to the following requirements:
   a. Joints between different grades of plastic pipe shall be made by use of an approved adapter fitting.
   b. Joints between the hub of cast iron soil pipe and plastic pipe shall be made by use of a mechanical joint of the compression or mechanical sealing type.
   c. Joints between plastic pipe and cast-iron pipe, steel pipe, glass pipe, copper tube, and other piping materials shall be made by use of an approved adapter fitting.
2. Plastic pipe, fittings, and solvent cement used for domestic hot and cold-water service shall bear the NSF seal for potable water.
3. Plastic pipe, fittings, and solvent cement shall not be used in systems where temperature, and operating pressure plus system static head, exceeds materials temperature and pressure limitations.
4. Plastic vent piping shall not pass-through roofs, firewalls, or fire partitions. Plastic waste and vent piping shall be installed in fire rated pipe chases when passing through floors or approved fire stop sleeve.
5. Plastic piping materials shall not be installed in air plenums, air chambers, or airshafts.

3.2 WELDING, BRAZING, AND SOLDERING

A. Operator and Procedure Qualifications: All welding and/or brazing operators and all welding and brazing procedures shall be qualified in accordance with the requirements of Section IX of the ASME Boiler and Pressure Vessel Code.

B. Welding:

1. All pipe welding performed under this division of the specifications shall be examined in accordance with ANSI B31.1 requirement for each piping system. The pipe weld examination is hereby made a part of the work of this division of the specifications. An independent outside inspection firm, regularly performing this type of examination, shall be hired by the contractor or subcontractor performing the welding as part of the work of their contract. The examination shall be performed by a representative of the Inspection Company (hereafter called the Inspector) who is qualified and certified for each examination method required.
2. The Inspection Company performing the examination shall certify in writing that all pipe welds performed under this contract conform to the requirements of ANSI B31.1 for each piping system and to all other governing codes.
3. Before final acceptance of the welded piping, certified test reports shall be submitted for review. The reports shall include the following data: name and location of project, date of test, type of piping system, working pressure and temperature, standard used for testing and applicable test method, number and location of welds tested and names of persons performing test.
4. Welders and procedures for fire protection system piping qualified in accordance with NFPA No. 13.

C. Brazing: Silver braze joints in accordance with MSS-SP-73 "Silver Brazing Joints for Wrought and Cast Solder Joint Fittings".

D. Soldering: Joints in copper tubing shall be made with solder type fittings. Outside surface of the tube where engaged in the fitting, and inside surface of the fitting in contact with the tube, shall be cleaned with an abrasive material before soldering. Self-cleaning compounds shall not be used. Care shall be taken to prevent annealing of tube and fittings when making connections. The solder joint shall be made with flux and wire form solder, except brazed joints. The flux shall be a mildly corrosive liquid or a petroleum-based paste containing chlorides of zinc and ammonium. Solder shall be applied and drawn through the full fitting length. Excess solder shall be wiped from joint before solder hardens. Joints in copper tube sizes 2-1/2 inches and larger shall be made with heat applied uniformly around the entire circumference of the tube and fittings by a multi-flame torch. Use of oxyacetylene cutting torch in lieu of multi-flame torch is not permitted. Disassemble valves and other accessories that may be damaged by heat before soldering.

3.3 TESTING OF PIPING SYSTEMS:

A. Each piping system, after erection, shall be subjected to a pressure test. The test requirements shall be as follows:

1. General: Furnish everything required for the tests. Notify Architect/Engineer at least 48 hours before any testing is performed. Independent Agent/Owner shall verify pressure test and sign off. Report to be furnished to Architect/Engineer. Testing shall be performed at the completion of each phase of the project.
2. Plumbing related systems shall be tested with water at not less than a 10-foot head. The water shall be kept in the systems for a period of not less than 15 minutes prior to start of visual examination. In lieu of water test, the systems may be tested with air at a uniform pressure of 5 psig, with no loss in pressure for a period of not less than 15 minutes.
3. The building sewer shall be tested by insertion of a test plug at the point of connection with the public sewer and filled with water under a head of not less than 10 feet, with no drop in water level for a period of not less than 15 minutes.
4. Domestic Water Distribution Systems shall be tested with water at the system working pressure, but not less than 100 psig and not for not less than 4 continuous hours. Joints will be visually examined for leaks.

5. Domestic Water Distribution Systems utilizing Viega Pro-Press fittings with SC Feature Contour Design shall be initially tested at a minimum of 1/2 psig but not more than 85 psig. Joints shall be visually examined for leaks.
6. Domestic Water Service System shall be tested with water at 150 psig. Joints will be visually examined for leaks.
7. Leaks, if any, shall be located, repaired, and retested in accordance with the test method specified for the system in which the leaks are located.

B. Prior to testing a system, the Contractor shall provide the proper Building Official and the Owner's Representative with not less than 72 hours notice of the proposed test. The Contractor shall obtain approval of the test results. Where written approval is required, the Contractor shall obtain such written approval and submit a copy of the approval.

C. Work requiring testing shall not be covered, or otherwise concealed, until testing is completed, and approval is granted.

D. Work, or portions of work, that is altered in any way after testing and approval shall be retested, witnessed, and approval obtained.

E. Systems requiring hydrostatic tests shall be protected from damage caused by freezing. After tests are completed drain all sections of pipe, including traps, or fill undrained sections and traps with antifreeze solution. Vent all high points to release vacuum and ensure complete drainage of closed systems and blow out piping with compressed air to remove trapped water.

F. Duration of tests, unless specified otherwise, shall be the time required to examine each joint in the system being tested.

G. Systems requiring hydrostatic testing under pressure shall be vented at high points to ensure that all piping is completely filled with the testing medium.

H. Disconnect pressure boosting apparatus, or vacuum pumps, during the test time span specified for systems employing the pressure loss/time span test method.

I. During tests, isolate system components that have test pressures less than pressures specified for system tests.

J. Use clean soapy water applied to exterior of joints to locate leaks in systems using compressed air, dry carbon dioxide, or nitrogen, under positive pressure as a test medium.

END OF SECTION

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SECTION 22 14 13 - FACILITY STORM DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

B. Refer to Section 22 05 00 for requirements pertaining to Common Work Results for Plumbing Systems.

1.2 WORK INCLUDED

A. Storm Water (ST) Piping.

1.3 DEFINITIONS

A. The pipe sizes given in this document are nominal.

1.4 QUALITY ASSURANCE

A. All material provided under this section shall be standard catalogued products of recognized manufacturers regularly engaged in the production of such products and shall be of the manufacturer's most recent design that is in regular production.

B. Each item provided under this section shall meet the requirements for that item as installed and used.

C. Each piping system shall be in accordance with the system design pressures shown in paragraph 2.1 - Materials, this specification section.

D. All materials provided under this section shall be new, except where the specifications and/or drawings permit the reuse of certain existing materials.

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this Section to the extent referenced. The publications are referenced in the text by the basic designation only.

B. The work and materials listed in this Section shall be provided in accordance with the standards and requirements set forth in the applicable portions of the latest editions of the referenced publications.

C. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.

1. American National Standards Institute (ANSI) Standards
2. American Petroleum Institute (API) Specification
3. American Society of Mechanical Engineers (ASME) Publications
4. American Society for Testing and Materials (ASTM) Publications
5. American Welding Society (AWS) Publication
6. American Water Works Association (AWWA) Standards
7. Cast Iron Soil Pipe Institute (CISPI) Standards
8. The Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS) Publications
9. National Fire Protection Association (NFPA) Standards
10. National Sanitation Foundation (NSF) Testing Laboratory Standards.
11. Plastic Pipe Institute (PPI) Manual.
12. Plumbing and drainage institute.
13. Underwriters Laboratories (UL)

1.6 UBMITTALS

A. All submittals shall be made in accordance with Section 22 05 00 requirements.

B. Submit a list identifying the specific type of material that will be used for each piping system. Include pipe, pipefittings, valves and joints. Include the basic designation of the publication applicable for each type of material and method.

C. Submit current welder qualifications for all welders proposed for this project. Welding certificates shall be for the company performing the welding at this project as directed in paragraph 3.2 - WELDING, BRAZING, AND SOLDERING.

D. Submit certified welding inspection reports as directed in paragraph 3.2 - WELDING, BRAZING, AND SOLDERING.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Storm Water (ST) Piping

1. Underground piping:
    a. No-hub cast iron pipe and fittings, CISPI Standard 301, ASTM A-888-98el.
    b. No-hub couplings, CISPE Standard 310-97.
    c. Charlotte Seal Gaskets, ASTM C-564-97, CISPI-HSN.
    d. Warco-Quik-Tite Gaskets, ASTM C-564-94, CISPI-HSN.
    e. Schedule 40, PVC - DWV drainage pattern, conforming to the following standards:
        i. ASTM D-1784 - Rigid PVC Vinyl Components.
        ii. ASTM D-1785 - PVC Plastic Pipe, Schedule 40.
        iii. ASTM D-2665 - PVC Drain, Waste and Vent Pipe and Fittings.
        iv. ASTM D-2564 - Solvent Cements for PVC Pipe and Fittings.
        v. NSF Standard 14 - Plastic Piping Components and Related Materials.
    f. Pipe Size 15 inches - PVC pipe and fittings, ASTM D-3034 or ASTM F-679, SDR 35 gasket.
    g. Pipe Size 18 inches, 21 inches, 24 inches and 27 inches - PVC pipe and fittings, ASTM F-679, SDR 35 gasket.
    h. PP Schedule 40 polypropylene, ASTM D635 and ASTM F1412, drainage pattern, mechanical joint stainless-steel components, ASTM B117. Polypropylene shall be used where indicated on the drawings and as specified herein.
2. Above-ground piping:
    a. No-hub cast iron pipe and fittings, CISPI Standard 301, ASTM A-888-98el.
    b. No-hub couplings, CISPI Standard 310.
    c. Charlotte Seal Gaskets, ASTM C-564, CISPI-HSN.
    d. Warco-Quik-Tite Gaskets, ASTM C-564-97, CISPI-HSN.
    e. Two inches and smaller Type DWV hard-drawn copper tubing, ASTM B-306 with copper drainage pattern and (lead-free) solder 95-5 Tin-antimony.
    f. Schedule 40, PVC-DWV drainage pattern, conforming to the following standards:
        i. ASTM D-1784 - Rigid PVC Vinyl Components.
        ii. ASTM D-1785 - PVC Plastic Pipe, Schedule 40.
        iii. ASTM D-2665 - PVC Drain, Waste and Vent Pipe and Fittings.

iv. ASTM D-2564 - Solvent Cements for PVC Pipe and Fittings.

v. NSF Standard 14 - Plastic Piping Components and Related Materials.

3. Steamers, commercial type dishwashers, commercial laundry equipment, and similar high temperature drainage piping, including the deep seal P-Trap from the floor drain to main branch run, shall be cast iron or polypropylene, no exceptions.
4. 1/2 inch to 1 inch: Same as domestic water, Type “L” hard-drawn, or Schedule 40 PVC pipe and solvent joint fittings.
5. 1-1/4 inches to 2 inches copper drainage tube, DWV Kitchen (Kitchen sinks and equipment waste).
6. Soda conduits shall be long sweep PVC conduit ells (R=24 inches) with solvent joints.
7. Elevator sump pump discharge pipe, inside pit shall be Schedule 40 galvanized steel A53/A106 with black, cast iron drainage fittings with threaded joints. Discharge piping beyond elevator pit wall, below slab, to be similar to sanitary waste, Schedule 40 PVC-DWV.
8. PVC Foam core DWV pipe, ASTM F891, is not and shall not be approved under any circumstances nor installed on this project.

2.2 MECHANICAL JOINT SYSTEMS

A. General:
1. All couplings, fittings, and gaskets shall be the products of a single manufacturer.
2. Valve ends shall be compatible with the couplings used on the connecting piping.

B. Pipe Wall Thickness (Schedule Number):
1. Where rolled groove joints are used, the pipe wall thickness may, in some cases, be decreased below that specified for the particular fluid system. In all cases, the minimum pipe wall thickness shall be in accordance with ANSI/ASME B31.9, Chapter II, using 150% of the system operating pressure as the design pressure.
2. Pipe having cut (machined) grooves shall have a nominal wall thickness of not less than the wall thickness specified for Schedule 40 pipe of the particular pipe size.
3. Non-metallic pipe shall not be joined with grooved-end pipe mechanical joints.

C. Couplings:
1. Mechanical joint couplings shall be of the external type, for use with cut or rolled-groove end pipes, fittings, and valves.
2. Couplings shall be self-centering and shall engage and lock-in-place the grooved-end pipes, fittings, and gaskets.
3. All couplings shall be of the rigid style. Flexible couplings shall not be used without the written approval of the Engineer.
4. Couplings shall be Ductile Iron, ASTM A536; or malleable iron, ASTM A47, and shall be designed for not less than 250 psig at 230-degrees F.
5. The coupling assembly shall be held together by two or more track-head, oval-neck steel bolts, ASTM A183.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
1. Furnish and install piping, fittings and appurtenances required to complete the piping systems shown on the drawings. Elbows shall be long radius type. Tees may not be field fabricated.

2. Run piping to true alignment, generally parallel or perpendicular to building walls, floors and ceilings, and with uniform grades and spacing, so as to present a neat and workmanlike appearance.
3. Care shall be paid to the exact locations of piping with respect to equipment, ducts, conduits, slabs, beams, lighting fixtures, columns, ceiling suspension systems, etc. to provide maximum access to mechanical and electrical equipment in the building. Close coordination and cooperation shall be exercised with other trades in locating the piping in the best interests of the Owner. The drawings and specifications covering other work to be done in the building shall be carefully studied and arrangements made to avoid conflict.
4. Not all necessary pipe offsets are indicated on the drawings because of the small scale. The various runs of piping to be installed shall be studied and adjustments made in exact routings as may be required for proper installation.
5. Conflicts arising during the erection of piping shall be brought to the attention of the Owner's Representative. No improvising or field changes will be permitted without the approval of the Owner's Representative.
9. Use full lengths of pipe wherever possible. Short lengths of pipe with couplings will not be permitted. Cut to exact measurement and install without forcing or spring unless otherwise shown on the drawings or specified.
10. Avoid tool marks and unnecessary pipe threads. Burrs formed when cutting pipe shall be removed by reaming. Before installing any pipe, care shall be taken that the inside is thoroughly cleaned and free of cuttings and foreign matter. Measures shall be taken to preserve this cleanliness after erection.
11. Arrange pipe connections to valves and specialties so that there is clearance for easy removal of the valve or specialty from the line, and also for the removal of the valve bonnet and interior, and the specialty top and bottom and interior, except where otherwise approved by the Owner's Representative.
12. Erect piping in such a manner so as to obtain sufficient flexibility and to prevent excessive stresses in materials and excessive bending movements at joints or connections to equipment. Make allowances throughout for expansion and contraction of piping. Provide each riser and horizontal run of piping with expansion loops, expansion joints, or expansion compensators where indicated and required. Securely anchor and adequately guide pipe as required or where indicated to force expansion to the expansion device without bending, binding, or misalignment of pipe. Branch connections from mains to risers shall be made with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Where indicated, in lieu of expansion loops, expansion joints, or expansion compensators, horizontal runs of pipe shall be anchored at approximately midway of the run to force expansion, evenly divided, toward the mains and risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that piping will spring enough to allow for expansion without straining.
13. Installed piping shall not interfere with the operations or accessibility of doors or windows and shall not encroach on aisles, passageways and equipment, and shall not interfere with the servicing or maintenance of any equipment. Adjacent pipelines shall be grouped in the same horizontal or vertical plane.
14. Where lines are purposely pitched for drainage, an accurate grade shall be maintained. No lines shall be supported in such a manner as to permit deflection, due to gravity, sufficient to pocket the lines when full of liquid. Grade mains as indicated by arrows on the drawings and in accordance with gradient as indicated in attached Piping Schedule.
15. Piping found to have water hammer or other objectionable vibrations which cannot be eliminated by proper grading or other natural means, shall be braced, trapped or hung with shock absorbing hangers and equipped with air chambers, mechanical shock absorbers, flexible pipe connections or otherwise silenced using approved means.

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16. Use building steel wherever possible for supporting pipe hangers. Main structural steel shall not be drilled, cut or burned for hangers without the approval of the Owner's Representative. Expansion bolts shall be used only upon the approval of the Owner's Representative.
17. Install unions or flanges in piping connections to equipment, regulating valves, and wherever necessary to facilitate the dismantling of piping and/or removal of valves and other items requiring maintenance.
18. Avoid bushings. Reducing fittings shall be used wherever practical.
19. The drawings indicate the size of piping and connections, and if certain sizes are omitted or unclear, obtain additional information before proceeding.
20. The piping drawings have been worked out with a view to the most economical installation, taking into consideration accessibility and appearances, and the Contractor must follow the drawings accurately and if it is found impractical to install the work in accordance with the drawings and specifications, the Contractor shall notify the Owner's Representative before making any changes and get their approval or revised drawings before proceeding with the work. Verify all measurements on the job before cutting pipes or having piping fabricated, and be responsible for the correct location of all pipe connections, also check sizes and standard of outlets on the equipment, including the dimensions and drilling of flanges, etc.
21. Copper tubing and galvanized steel shall not be mixed in any one run of piping.
22. Change in direction shall be made with fittings, except that bending of steel and copper pipe 4 inches and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. The centerline radius of bends shall be not less than 6 diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations is not acceptable.
23. Threaded joints shall be made with tapered threads in accordance with ANSI B2.1, and made tight with an approved pipe thread joint compound or material, applied to the male threads only. Use compounds sparingly and apply with caution to ensure that compounds do not enter piping systems. When pipe joint is made up a maximum of 3 threads shall be visible.
24. Joints for plastic pipe shall be made in accordance with PPI Piping Manual.
25. Connections between ferrous and nonferrous metallic pipe shall be made with dielectric unions or flanges.
26. Connections between plastic and metallic pipe, between plastic and glass pipe, and between metallic and glass pipe, shall be made with transition fittings manufactured for the specific purpose.
27. Unions and flanges shall not be concealed in walls, partitions, or above inaccessible ceilings.

B. Plumbing Systems Additional Requirements:

1. Bends, plugs, or tees in water service lines, except soldered or screwed joints, shall be braced or clamped. The connection between the water service line and the domestic water distribution line shall be anchored by means of tie rods and pipe clamps.
2. Before connecting the domestic water system to underground supply connections, each supply connection shall be thoroughly flushed of all foreign matter.
3. Vertical cast iron soil pipe hubs inside buildings shall extend 6 inches above concrete slab-on-grade floors.
4. Provide test tees with screwed plugs in waste and vent systems to isolate sections of system previously tested from section of system under test. Distance between test tees on vertical lines shall not exceed static height allowable for system pressure limitations. All

joints in test tees, including plugs, shall be tested under pressure as specified for system tests.

5. Joints between cast iron pipe and copper tube shall be made by using a brass-caulking ferrule and properly soldering the copper tube to the ferrule prior to pouring the lead.
6. Joints between cast iron and vitrified clay piping shall be made using either hot poured bitumastic compound, or by a preformed elastomeric ring conforming to ASTM C564. The ring shall, after ramming, completely fill the annular space between the cast iron spigot and the vitrified clay hub.
7. Joints between copper tubing and threaded pipe shall be made by the use of brass adapters or dielectric fittings. The joint between the copper tubing and the fitting shall be soldered, and the connection between the threaded pipe and the fitting shall be a standard pipe size screw joint.
8. Joints between steel and cast-iron pipe shall be either caulked or threaded, or made with approved adapter fittings.
9. Install horizontal drainage piping in uniform alignment at uniform slopes that will produce a computed velocity of not less than 2 feet per second when flowing half full, or a minimum of 1/8 inch per ft. unless noted otherwise.
10. The underground water service pipe and the building sewer shall be not less than 10 feet apart horizontally, and shall be separated by undisturbed, or compacted, earth, unless the following requirements are satisfied:
    a. The water service pipe and the building sewer may be installed in the same trench, provided written approval is given by the plumbing official and the following conditions are met:
        i. The bottom of the water service pipe at all points shall be not less than 12 inches above the top of the sewer line at its highest point.
        ii. The water service pipe shall be placed on a solid shelf excavated at one side of the common trench.
        iii. The number of joints in the service pipe shall be kept to a minimum.
        iv. The materials and joints in the sewer pipe shall be installed in such manner, and shall possess the necessary strength and durability, to prevent the escape of solids, liquids, and gases there from under all known adverse conditions such as corrosion, strains due to temperature changes, settlements, vibration, and superimposed loads.
        v. Where the water service line must cross the building sewer line, the bottom of the water service line within 10 feet of the point of crossing shall be at least 12 inches above the top of the sewer line. The sewer line shall be of cast iron, with leaded or mechanical joints, within 10 feet of the point of crossing.
11. Provide access panel for all valves located above non-accessible ceiling. Coordinate with Architectural plans for exact locations.
12. Provide clean-outs at the base of all sanitary waste and vent stacks.
13. When a PVC or CPVC piping system is employed, the final rough-in piping shall transition from CPVC to Type “L” copper tubing at penetration of wall construction to the fixture. The copper piping rough-in shall employ the usage of the “Hold Rite” support system to prevent movement of branch tubing. No exceptions.
14. Installation of copper tubing shall be per FPC, ASTM B32-96, and per Copper Development Association and ASTM B828-92-E01.
15. Install plugs or caps on all openings during the construction phase. The temporary plug shall be cap of same material as pipe. Duct tape is unacceptable for use as a plug for the construction phase.

16. All penetrations of piping through walls shall be made insect proof, (i.e., penetrations of waste arms, hot and cold-water piping through walls below sinks, lavatories, water closets, etc.). The escutcheon plate does constitute an “insect proof” closure.
17. Installation of CPVC tubing shall be per State of Florida Plumbing Code, “PPFA Installation Handbook for CPVC hot and Cold Water Piping” including Flow Guard Gold, Noveon, Inc. Contractor shall certify that he has been trained by manufacturer on techniques for installation of CPVC tubing systems. Manufacturer shall warranty materials and labor for a 5-year period against all leaks using CPVC tubing. CPVC tubing shall not be installed in the laundry or in areas where piping is subject to extreme physical damage, (i.e., the kitchen).
18. Teflon tape shall be used on threaded connections. A CPVC/brass adapter nipple shall be installed where piping penetrates wall to connect to flush valves. Cast brass “drop-ear” elbows shall be secured to wall construction for copper run out to hose bibs and shower heads. CPVC stub-outs for lavatories and sinks may be used. CPVC shall not be used within 1’-0” of the gas water heater’s flue vent or for hot water supply and return piping between gas water heater and storage tank. Expansion loops on hot water system shall be installed per manufacturer’s instructions to suit temperature and pipe run.
19. Mechanically formed branch connections, commonly termed extruded outlets, shall be made in a continuous operation consisting of producing a pilot hole, drawing out the tube/pipe surface to form an outlet and facing of the outlet rim (including beveling when required). An integral pipe heating operation may be included, after the cutting of the pilot hole on Schedule 40 wall thickness. The outlet device shall be fully adjustable to insure proper tolerance and complete uniformity of the joint. Materials should have a minimum elongation of 20-25% to be acceptable for forming.
20. The extruded outlet and butt weld connection shall be in accordance with ASME Boiler and Pressure Vessel Code, as listed under ANSI B31 Standards.

C. Plastic Pipe Systems Additional Requirements:
    1. Joints between plastic pipe and other materials shall be subject to the following requirements:
        a. Joints between different grades of plastic pipe shall be made by use of an approved adapter fitting.
        b. Joints between the hub of cast iron soil pipe and plastic pipe shall be made by use of a mechanical joint of the compression or mechanical sealing type.
        c. Joints between plastic pipe and cast-iron pipe, steel pipe, glass pipe, copper tube, and other piping materials shall be made by use of an approved adapter fitting.
    2. Plastic pipe, fittings, and solvent cement used for domestic hot and cold-water service shall bear the NSF seal for potable water.
    3. Plastic pipe, fittings, and solvent cement shall not be used in systems where temperature, and operating pressure plus system static head, exceeds materials temperature and pressure limitations.
    4. Plastic vent piping shall not pass-through roofs, firewalls, or fire partitions. Plastic waste and vent piping shall be installed in fire rated pipe chases when passing through floors or approved fire stop sleeve.
    5. Plastic piping materials shall not be installed in air plenums, air chambers, or airshafts.

D. Mechanical Joint System Additional Requirements: Install in strict accordance with the manufacturer's written installation instructions.

3.2 WELDING, BRAZING, AND SOLDERING

A. Operator and Procedure Qualifications: All welding and/or brazing operators and all welding and brazing procedures shall be qualified in accordance with the requirements of Section IX of the ASME Boiler and Pressure Vessel Code.

B. Welding:

1. All pipe welding performed under this division of the specifications shall be examined in accordance with ANSI B31.1 requirement for each piping system. The pipe weld examination is hereby made a part of the work of this division of the specifications. An independent outside inspection firm, regularly performing this type of examination, shall be hired by the contractor or subcontractor performing the welding as part of the work of their contract. The examination shall be performed by a representative of the Inspection Company (hereafter called the Inspector) who is qualified and certified for each examination method required.
2. The Inspection Company performing the examination shall certify in writing that all pipe welds performed under this contract conform to the requirements of ANSI B31.1 for each piping system and to all other governing codes.
3. Before final acceptance of the welded piping, certified test reports shall be submitted for review. The reports shall include the following data: name and location of project, date of test, type of piping system, working pressure and temperature, standard used for testing and applicable test method, number and location of welds tested and names of persons performing test.
4. Welders and procedures for fire protection system piping qualified in accordance with NFPA No. 13.

C. Brazing: Silver braze joints in accordance with MSS-SP-73 "Silver Brazing Joints for Wrought and Cast Solder Joint Fittings".

D. Soldering: Joints in copper tubing shall be made with solder type fittings. Outside surface of the tube where engaged in the fitting, and inside surface of the fitting in contact with the tube, shall be cleaned with an abrasive material before soldering. Self-cleaning compounds shall not be used. Care shall be taken to prevent annealing of tube and fittings when making connections. The solder joint shall be made with flux and wire form solder, except brazed joints. The flux shall be a mildly corrosive liquid or a petroleum-based paste containing chlorides of zinc and ammonium. Solder shall be applied and drawn through the full fitting length. Excess solder shall be wiped from joint before solder hardens. Joints in copper tube sizes 2-1/2 inches and larger shall be made with heat applied uniformly around the entire circumference of the tube and fittings by a multi-flame torch. Use of oxyacetylene cutting torch in lieu of multi-flame torch is not permitted. Disassemble valves and other accessories that may be damaged by heat before soldering.

3.3 TESTING OF PIPING SYSTEMS:

A. Each piping system, after erection, shall be subjected to a pressure test. The test requirements shall be as follows:

1. Plumbing related systems shall be tested with water at not less than a 10 foot head. The water shall be kept in the systems for a period of not less than 15 minutes prior to start of visual examination. In lieu of water test, the systems may be tested with air at a uniform pressure of 5 psig, with no loss in pressure for a period of not less than 15 minutes.
2. The building sewer shall be tested by insertion of a test plug at the point of connection with the public sewer and filled with water under a head of not less than 10 feet, with no drop in water level for a period of not less than 15 minutes.
3. Leaks, if any, shall be located, repaired, and retested in accordance with the test method specified for the system in which the leaks are located.

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B. Prior to testing a system, the Contractor shall provide the proper Building Official and the Owner's Representative with not less than 72 hours notice of the proposed test. The Contractor shall obtain approval of the test results. Where written approval is required, the Contractor shall obtain such written approval, and submit a copy of the approval.

C. Work requiring testing shall not be covered, or otherwise concealed, until testing is completed, and approval is granted.

D. Work, or portions of work, that is altered in any way after testing and approval shall be retested, witnessed, and approval obtained.

E. Systems requiring hydrostatic tests shall be protected from damage caused by freezing. After tests are completed drain all sections of pipe, including traps, or fill undrained sections and traps with antifreeze solution. Vent all high points to release vacuum and ensure complete drainage of closed systems and blow out piping with compressed air to remove trapped water.

F. Duration of tests, unless specified otherwise, shall be the time required to examine each joint in the system being tested.

G. Systems requiring hydrostatic testing under pressure shall be vented at high points to ensure that all piping is completely filled with the testing medium.

H. Disconnect pressure boosting apparatus, or vacuum pumps, during the test time span specified for systems employing the pressure loss/time span test method.

I. During tests, isolate system components that have test pressures less than pressures specified for system tests.

J. Use clean soapy water applied to exterior of joints to locate leaks in systems using compressed air, dry carbon dioxide, or nitrogen, under positive pressure as a test medium.

END OF SECTION

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SECTION 22 16 00 - GAS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Refer to Section 22 05 00 for requirements pertaining to Common Work Results for Plumbing Systems.

1.2 WORK INCLUDED

A. Propane (P) & Natural Gas (G) Piping

1.3 DEFINITIONS

A. The pipe sizes given in this document is nominal.

1.4 QUALITY ASSURANCE

A. All material provided under this section shall be standard catalogued products of recognized manufacturers regularly engaged in the production of such products and shall be of the manufacturer's most recent design, that is in regular production.

B. Each item provided under this section shall meet the requirements for that item as installed and used, in accordance with the following standards:

1. Metallic Piping Systems employing mechanical joints and grooved-end pipe - ASME/ANSI B-31.9
2. All other metallic piping - ASME/ANSI B31.1

C. Each piping system shall be in accordance with the system design pressures shown in paragraph 2.1 - Materials, this specification section.

D. All materials provided under this section shall be new, except where the specifications and/or drawings permit the reuse of certain existing materials.

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this Section to the extent referenced. The publications are referenced in the text by the basic designation only.

B. The work and materials listed in this Section shall be provided in accordance with the standards and requirements set forth in the applicable portions of the latest editions of the referenced publications.

C. All cast iron soil pipes and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.

1. American National Standards Institute (ANSI) Standards
2. American Petroleum Institute (API) Specification
3. American Society of Mechanical Engineers (ASME) Publications
4. American Society for Testing and Materials (ASTM) Publications
5. American Welding Society (AWS) Publication
6. American Water Works Association (AWWA) Standards
7. Cast Iron Soil Pipe Institute (CISPI) Standards
8. The Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS) Publications
9. National Fire Protection Association (NFPA) Standards
10. National Sanitation Foundation (NSF) Testing Laboratory Standards.

12. Plastic Pipe Institute (PPI) Manual.
13. Underwriters Laboratories (UL)

1.6 SUBMITTALS

A. All submittals shall be made in accordance with Section 22 05 00 Requirements.

B. Submit a list identifying the specific type of material that will be used for each piping system. Include pipes, pipefittings, valves and joints. Include the basic designation of the publication applicable for each type of material and method.

C. Submit current welder qualifications for all welders proposed for this project. Welding certificates shall be for the company performing the welding at this project as directed in paragraph 3.2 - WELDING, BRAZING, AND SOLDERING.

D. Submit certified welding inspection reports as directed in paragraph 3.2 - WELDING, BRAZING, AND SOLDERING.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Propane (P) Piping

1. Natural gas system shall be in accordance with the Florida Fuel Gas Code 2010 and NFPA 54
2. CSST piping - above ground: Corrugated stainless-steel tubing manufactured from ASTM A240, type 304 stainless steel with a minimum nominal wall thickness of 0.010". System shall comply with ANSI LC-1/CSA 6.26 "Standard for Fuel Gas Piping Using Corrugated Stainless-Steel Tubing (CSST). CSST shall have a extruded fire-retarded yellow polyethylene jacket meeting the flame spread and smoke density requirements of ASTM E-84.
3. CSST piping - underground: Underground piping shall be manufactured and shall be in accordance with standards noted above. Underground piping shall consist of CSST sleeved with a black integral polyethylene sleeve. The external polyethylene sleeve shall be designed to withstand the superimposed loads. The external protective sleeve shall have internal vent channels lengthwise to direct any leakage along the pipe the end fittings. The construction of the pre-sleeved system shall provide the encasement and venting capabilities required by the code. Underground fittings may be used within the system. All metallic parts of the buried fittings shall be wrapped in a code-approved manner as recommended by manufacturer. UNDERGROUND FITTINGS ARE NOT PERMITTED UNDER THE SLAB OF A BUILDING.
4. Gas pipe venting shall be in accordance with Florida Fuel Gas Code 2010 and NFPA 54.
5. Acceptable Manufacturers:
    a. TracPipe
    b. Gastite

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Furnish and install piping, fittings and appurtenances required to complete the piping systems shown on the drawings. Elbows shall be long radius type. Tees may not be field fabricated.
2. Run piping to true alignment, generally parallel or perpendicular to building walls, floors and ceilings, and with uniform grades and spacing, so as to present a neat and workmanlike appearance.

3. Care shall be paid to the exact locations of piping with respect to equipment, ducts, conduits, slabs, beams, lighting fixtures, columns, ceiling suspension systems, etc. to provide maximum access to mechanical and electrical equipment in the building. Close coordination and cooperation shall be exercised with other trades in locating the piping in the best interests of the Owner. The drawings and specifications covering other work to be done in the building shall be carefully studied and arrangements made to avoid conflict.
4. Not all necessary pipe offsets are indicated on the drawings because of the small scale. The various runs of piping to be installed shall be studied and adjustments made in exact routings as may be required for proper installation.
5. Conflicts arising during the erection of piping shall be brought to the attention of the Owner's Representative. No improvising or field changes will be permitted without the approval of the Owner's Representative.
6. Use full lengths of pipe wherever possible. Short lengths of pipe with couplings will not be permitted. Cut to exact measurement and install without forcing or spring unless otherwise shown on the drawings or specified.
7. Avoid tool marks and unnecessary pipe threads. Burrs formed when cutting pipe shall be removed by reaming. Before installing any pipe, care shall be taken that the inside is thoroughly cleaned and free of cuttings and foreign matter. Measures shall be taken to preserve this cleanliness after erection.
9. Arrange pipe connections to valves and specialties so that there is clearance for easy removal of the valve or specialty from the line, and also for the removal of the valve bonnet and interior, and the specialty top and bottom and interior, except where otherwise approved by the Owner's Representative.
10. Erect piping in such a manner so as to obtain sufficient flexibility and to prevent excessive stresses in materials and excessive bending movements at joints or connections to equipment. Make allowances throughout for expansion and contraction of piping. Provide each riser and horizontal run of piping with expansion loops, expansion joints, or expansion compensators where indicated and required. Securely anchor and adequately guide pipe as required or where indicated to force expansion to the expansion device without bending, binding, or misalignment of pipe. Branch connections from mains to risers shall be made with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Where indicated, in lieu of expansion loops, expansion joints, or expansion compensators, horizontal runs of pipe shall be anchored at approximately midway of the run to force expansion, evenly divided, toward the mains and risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that piping will spring enough to allow for expansion without straining.
11. Installed piping shall not interfere with the operations or accessibility of doors or windows and shall not encroach on aisles, passageways and equipment, and shall not interfere with the servicing or maintenance of any equipment. Adjacent pipelines shall be grouped in the same horizontal or vertical plane.
12. Where lines are purposely pitched for drainage, an accurate grade shall be maintained. No lines shall be supported in such a manner as to permit deflection, due to gravity, sufficient to pocket the lines when full of liquid. Grade mains as indicated by arrows on the drawings and in accordance with gradient as indicated in attached Piping Schedule.
13. Use building steel wherever possible for supporting pipe hangers. Main structural steel shall not be drilled, cut or burned for hangers without the approval of the Owner's Representative. Expansion bolts shall be used only upon the approval of the Owner's Representative.
14. Install unions or flanges in piping connections to equipment, regulating valves, and wherever necessary to facilitate the dismantling of piping and/or removal of valves and other items requiring maintenance.

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15. Avoid bushings. Reducing fittings shall be used wherever practical.
16. The drawings indicate the size of piping and connections, and if certain sizes are omitted or unclear, obtain additional information before proceeding.
17. The piping drawings have been worked out with a view to the most economical installation, taking into consideration accessibility and appearances, and the Contractor must follow the drawings accurately and if it is found impractical to install the work in accordance with the drawings and specifications, the Contractor shall notify the Owner's Representative before making any changes and get their approval or revised drawings before proceeding with the work. Verify all measurements on the job before cutting pipes or having piping fabricated, and be responsible for the correct location of all pipe connections, also check sizes and standard of outlets on the equipment, including the dimensions and drilling of flanges, etc.

B. Gas Systems Additional Requirements:

1. Installation shall be in accordance with NFPA No. 54 and ANSI Z 223.1 unless specified otherwise herein.
2. Provide a capped 6" dirt leg at the base of main risers.
3. Valves in natural gas service shall be lubricated plug cocks.
4. Horizontal pipe shall slope upward, in the direction of flow, at not less than 1/4 inch in 15 feet.
5. Where piping is concealed, all plugged or capped openings shall be exposed and accessible. Bushings and unions shall not be used in concealed work.
6. Branch connections shall be made on the side or top of the main for both up-feed and down-feed applications.
7. Vent gas pressure regulator and safety shut-off reverse vent valve relief lines to outside the building individually. Relief lines from pressure switches may be combined in another line, or run separate, for venting to the outside.
8. After testing is completed, and before connecting any appliances, all piping shall be fully purged. Piping shall not be purged into the combustion chamber of an appliance. The open end of piping systems being purged shall not discharge into confined spaces or areas where there are ignition sources unless the safety precautions recommended in NFPA No. 54, or ANSI Z 223.1 are followed.
9. After the piping has been placed in operation, all equipment shall be purged and then placed in operation, as necessary.

3.2 TESTING OF PIPING SYSTEMS:

A. Each piping system, after erection, shall be subjected to a pressure test. The test requirements shall be as follows:

1. Gas Piping Systems shall be tested with air at not less than 25 PSIG for a period of not less than 15 minutes without showing any drop in pressure.
2. Gas Distribution Systems utilizing Copper Viega Pro-Press fittings with SC Feature Contour Design shall be initially tested at a minimum of 1/2 psig but not more than 50 psig. Joints shall be visually examined for leaks.
3. Leaks, if any, shall be located, repaired, and retested in accordance with the test method specified for the system in which the leaks are located.

B. Prior to testing a system, the Contractor shall provide the proper Building Official and the Owner's Representative with not less than 72 hours notice of the proposed test. The Contractor shall obtain approval of the test results. Where written approval is required, the Contractor shall obtain such written approval, and submit a copy of the approval.

C. Work requiring testing shall not be covered, or otherwise concealed, until testing is completed, and approval is granted.

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D. Work, or portions of work, that is altered in any way after testing and approval shall be retested, witnessed, and approval obtained.

E. Duration of tests, unless specified otherwise, shall be the time required to examine each joint in the system being tested.

F. During tests, isolate system components that have test pressures less than pressures specified for system tests.

G. Use clean soapy water applied to exterior of joints to locate leaks in systems using compressed air, dry carbon dioxide, or nitrogen, under positive pressure as a test medium.

END OF SECTION

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SECTION 22 17 00 - PUMPS FOR PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

B. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Inline Circulator Pumps - Potable Water Service.

1.3 QUALITY ASSURANCE

A. Maximum suction velocity shall be less than 10 FPS. Pump discharge velocity shall be less than to 14 FPS

B. Pump selections shall be no more than 5% less than the scheduled pump efficiency.

C. Maximum impeller diameter shall not exceed 85% of the cutwater diameter.

D. Pump motors shall be NEMA Premium™ Efficiency as listed in Section 23 05 13 – Motor Requirements for HVAC Equipment. Motors for pumps with variable speed drive must have Class F insulation.

E. Pumps shall be factory tested, thoroughly cleaned and painted. Discharge and suction shall be factory covered to protect the volute/impeller from dirt and damage during shipment and storage.

F. Pumps shall be constructed with materials and standards which have been tested or proven and have published test data available if requested, stating that these materials and standards have been found acceptable for use in pump manufacturing by one or more of the following:

1. American Society for Testing and Materials (ASTM)
2. International Organization for Standardization (ISO)
3. American National Standards Institute (ANSI)
4. National Electrical Manufacturers Association (NEMA)

1.4 SUBMITTALS

A. Submit dimensioned performance and product data for acceptance.

B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

C. Submit in accordance with Division 1 Requirements.

D. Additional submittal requirements:

1. Submit pump curves with pump operating point plotted brake horsepower and pump efficiency indicated on curve.
2. Where two or more pumps are operating in parallel, submit combined pump curve with all pump operating points plotted, system curve indicated, and brake horsepower and pump efficiency indicated on curve.
3. Where pumps are used in open type systems (i.e., condenser water) submit net positive suction head curve (NPSH) with the system requirements plotted.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Inline Circulator Pumps - Potable Water Service:

1. Armstrong Pump Company

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2. Aurora
3. Bell & Gossett
4. PACO
5. Peerless
6. Taco
7. Weinman

2.2 EQUIPMENT

A. Inline Circulator Pumps - Potable Water Service:

1. Type: Centrifugal, single stage, close coupled in-line, back pull-out design, suitable for horizontal operation.
2. Casing: Bronze split case, bronze fitted rated for 175 psi suction and discharge gauge tapping, flanged or threaded suction and discharge with companion flange bolts and gaskets.
3. Impeller: Brass, totally enclosed, hydraulically and dynamically balanced, keyed to the shaft, and secured with a locknut.
4. Shaft: Steel with copper sleeve through seal chamber.
5. Seals: Carbon rotating against a stationary ceramic seat.
6. Bearings: Oil lubricated bronze journal bearings.
7. Drive: Direct close coupled with flexible coupling.
8. Motor: Outdoor applications shall have a TEFC (Totally Enclosed Fan Cooled) motor and indoor locations shall have an open drip-proof motor; voltage and horsepower as scheduled. See Specification Section 23 05 13 for additional motor requirements.
9. Range: 40-degrees F to 230-degrees F.

PART 3 - EXECUTION

3.1 GENERAL

A. Install in accordance with manufacturers written instructions.

3.2 INSTALLATION

A. Inline Circulator Pumps - Potable Water Service:

1. Support pipe as close to pump as valve assemblies will allow.
2. Provide adequate access and service area.

END OF SECTION

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SECTION 23 02 00 - BASIC MATERIALS AND METHODS OF HVAC SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

B. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Access doors.

B. Piping and equipment identification.

C. Electrical requirements.

D. Painting.

E. Concrete work.

F. Fabricated steel supports.

G. Excavation, trenching and backfilling.

H. Placing of equipment.

1.3 RELATED WORK

A. DIVISION 9 - FINISHES (Access Doors - Painting).

B. DIVISION 3 - CONCRETE.

C. DIVISION 31- SITEWORK (Excavation).

1.4 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this Section to the extent referenced.

1. American Institute of Steel Construction (AISC) Publications
2. American National Standards Institute (ANSI) Standards
3. American Society for Testing and Materials (ASTM) Publications
4. American Welding Society (AWS) Publications
5. Underwriters Laboratories, Inc. (UL) Standards

1.5 SUBMITTALS

A. General: Where submittals are required, comply with Division 1requirements.

B. Shop Drawings:

1. Submit drawings of fabricated steel supports where proposed supports are not in accordance with details on drawings, or where drawings do not detail supports. Submittal for acceptance is required.
2. Submit drawings indicating locations of all access doors proposed to be installed in ductwork. Submittal for acceptance is required.

C. Product Data: Submittal for other than fabricated steel supports is not required. Product data for the following shall be included in the operation and maintenance manuals. Submittal for acceptance is not required.

1. Access doors.
2. Piping and equipment identification.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Access Doors:
   1. Acudor
   2. Elmodor Manufacturing, Co.
   3. Karp Metal Associates, Inc.
   4. Larsen's Manufacturing Co.
   5. Milcor
   6. Engineer-approved Equal

B. Piping and Equipment Identification:
   1. Communications Technology Corp.
   2. Craftmark Identification Systems, Inc.
   3. EMED Co., Inc.
   4. Florida Marking Products, Inc.
   5. Marking Services, Inc.
   6. Seton Name Plate Corp.
   7. W.H. Brady Co., Signmark Division
   8. Engineer-approved Equal

2.2 FABRICATION

A. Access doors:
   1. Access doors: UL labeled where installed in fire rated walls, partitions, and ceilings. Door rating shall be not less than wall, partition, or ceiling rating.
   2. Frames: 16-gauge steel, flush trim, with corners welded and ground smooth, masonry anchor strap for masonry walls, bolt holes for mounting in framed openings.
   3. Non-fire rated doors: 13-gauge steel, concealed continuous piano hinge with dust flap, flush screwdriver operated lock with stainless steel cam and studs.
   4. Fire rated doors: 20-gauge steel welded pan type, concealed continuous piano hinge with stainless steel pins, key-operated latch bolt, interior latch release, automatic door closer, automatic door latch when door closes. The door panel shall contain 2-inch-thick insulation in sandwich type construction.
   5. Finish of doors and frames: Prime coat of rust inhibitive baked enamel, except as specified otherwise.
   6. Finish of doors and frames in wet areas, and in areas with surfaces subject to wet cleaning: No. 4 satin stainless steel.

B. Piping and Equipment Identification:
   1. Pipe markers: Sub-surface printed plastic, with protective undercoating. Markers shall be permanently curled for snap-on installation for pipe sizes (including insulation) up to 6 inch diameter. For external diameters above 8 inches. Marker shall be secured using cable ties for indoor use and stainless-steel banding or ultraviolet resistant plastic for exterior use. Markers for outdoor installation shall be over-laminated with Tedlar™ on polyester ultraviolet damage and fading. Markers shall identify the pipe contents and direction of flow through 360-degree visibility range. Marker size, letter size, letter color, wording and background color shall be in accord with ANSI A13.1 - Scheme for the Identification of

Piping Systems. Based on Marking Services Inc. Model MS-970 Coiled Plastic Markers for indoor use and Model MS-995 Maxilar Marker for exterior use.

2. Valve tags: Contractors Option:
   a. Indoor:
      i. 19-gauge brass, 1-1/2-inch round, with 1/4-inch-high black pipe service letter abbreviation above 1/2-inch-high black valve number. Pipe service letter abbreviation shall be in accord with legend on drawings. Valve tag attachment shall be 4 ply 0.018 copper wire meter seal or #6 solid brass bead chain with locking link. Based on Marking Services Inc.
      ii. 1/16-inch-thick plastic, 1-1/2-inch round, with 1/4-inch-high black pipe service abbreviation above 1/2-inch-high black valve number. Pipe service letter abbreviation shall be in accord with legend on drawings. Color of valve tag shall match pipe marker color. Valve tag attachment shall be 4 ply 0.018 copper wire meter seal or #6 solid brass bead chain with locking link. Based on Marking Services Inc.
   b. Outdoor Service:
      i. 19-gauge brass, 1-1/2-inch round, with 1/4-inch-high black pipe service letter abbreviation above 1/2-inch-high black valve number. Pipe service letter abbreviation shall be in accord with legend on drawings. Valve tag attachment shall be 4 ply 0.018 copper wire meter seal or #6 solid brass bead chain with locking link. Based on Marking Services Inc.
      ii. 19-gauge Type 304 stainless steel, 1-1/2-inch round, with 1/4-inch-high pipe service abbreviation above 1/2-inch-high black valve number. Pipe service letter abbreviation shall be in accordance with legend on drawings. Color of valve tag shall match pipe marker color. Valve tag attachment shall be 4 ply 0.018 stainless wire meter seal or #6 Type 304 stainless steel bead chain with locking link. Based on Marking Services, Inc.
3. Valve chart frame: Self-closing, satin-finished, extruded aluminum with glass window, 8-1/2 inch by 11-inch chart size.
4. Equipment nameplates:
   a. Indoor: Shall be 1/16-inch-thick plastic with black satin surface and white core. Lettering shall be engraved through the surface color to expose the core color. Plate size shall be a minimum of 2-1/2 inch by 4 inch, with 3/4-inch-high lettering for equipment and 3/4 inch by 2-1/2 inch, with 3/16-inch-high lettering for ceiling grid labeling. Equipment identifying name and number shall be in accord with schedules on the Contract Documents. Plate manufacturer shall furnish pre-drilled hole locations for pop riveting. Where pop riveting is not suitable, a suitable adhesive for permanently attaching plate to equipment shall be provided.
   b. Outdoor: Shall be 125 Mil rigid plastic constructed of printed legend sealed between two layers of chemically resistant plastic to resist ultraviolet damage. Plate size shall be a minimum of 2-1/2 inch by 4 inch, with 3/4-inch-high lettering for equipment. Equipment identifying name and number shall be in accord with schedules on the Contract Documents. Plate manufacturer shall furnish pre-drilled hole locations for pop riveting. Where pop riveting is not suitable, a suitable adhesive for permanently attaching plate to equipment shall be provided.
   c. Based on Marking Services Inc. Model MS-215 Max-Tex.

C. Electrical Requirements: Product description not applicable to this Section.

D. Painting: Product specified in Division 9 - FINISHES.

E. Concrete Work: All work is provided under Division 3.

F. Fabricated Steel Supports:
   1. Steel angles, channels, and plate shall be in accordance with ASTM A36.
   2. Steel members, including fasteners, exposed to weather shall be galvanized.

G. Excavation, Trenching, and Backfilling: Product description not applicable.

H. Placing of Equipment: Product description not applicable.

PART 3 - EXECUTION

3.1 GENERAL

A. Installation of materials and equipment shall be in accord with the manufacturer's written instructions, except as specified.

3.2 INSTALLATION

A. Access Doors:
   1. Furnish access doors for installation under Division 9 - FINISHES.
   2. Deliver access doors to the appropriate trade well in advance of the time they are needed so as to avoid unnecessary delay of the work.
   3. Access doors shall be sized as indicated on drawings. If no size is given, provide access door of size suitable for servicing equipment or valve. Unless otherwise noted, the minimum size for an access door shall be 12" x 12".
   4. Access doors shall be provided where indicated and if not indicated, where required.
   5. Access doors shall be installed so as to allow full door swing.
   6. Where full swing and access is not possible, removable doors shall be provided.
   7. Access doors not required in lay-in tile ceilings.

B. Piping and Equipment Identification:
   1. Install pipe markers adjacent to each valve and fitting, at each branch connection, on each side of wall, floor, and ceiling penetrations, where entering and leaving underground areas, and at minimum 40 foot spacing on horizontal and vertical pipe runs. Markers shall be arranged for easy reading at eye level.
   2. Provide valve tags on all valves exposed or concealed unless otherwise noted.
   3. Attach valve tag to stem of each valve to be tagged. Valve numbers shall follow in sequence the Owner's existing valve numbers, where applicable.
   4. Provide a marker for each valve and equipment to be tagged, located above lift-out tile ceilings. The marker shall be 1/16-inch-thick plastic with a satin surface and white core. Color of the marker shall match color of piping identification system. Lettering shall be engraved through the surface color to expose the core color. Plate size shall be 3/4 inch by 2-1/2 inch, with 3/16-inch-high lettering for ceiling grid labeling. Plate manufacturer shall furnish suitable adhesive for permanently attaching plate to ceiling grid.
   5. Provide a minimum of 4 valve charts. Chart information shall indicate job name, Contractor name, date of installation, valve number, valve location, valve type, valve purpose, and system in which installed. Mount framed chart in equipment room and insert copy of chart in each operating and maintenance manual under separate tabbed section labeled "Valve Chart". Where project drawings include a piping flow schematic, request AutoCAD file from Engineer and label all of the valves according to the valve chart and frame in an 18” x 24” frame in main mechanical or pump room.
   6. Provide air and water flow diagrams installed in waterproof, laminated frames on the wall in each Mechanical Room. Air flow diagrams shall show locations of dampers, sensors, and exhaust fans associated with the air handling unit. Water flow diagrams shall show shut-off valves and control valve locations.

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7. Permanently affix nameplate to each item of equipment using stainless steel pop rivets. Where irregular surface impedes direct attachment of plates, affix plate to sheet metal bracket and attach bracket to equipment with screws, bolts or suitable adhesive from nameplate manufacturer.
8. Refrigeration System - Additional Requirements:
    a. Marking and Signage:
        i. Provide a permanent sign containing the following information:
            a) Name and address of installer.
            b) Kind of refrigerant.
            c) Lbs. of refrigerant.
            d) Field test pressure applied.
        ii. Provide a permanent sign: Main electrical supply, i.e., main compr. disc.
        iii. Provide metal tags with 0.5 inch letters:
            a) Shut-off valves to each vessel, i.e., L.P. receiver shut-off.
            b) Relief valve.
        iv. Piping shall be marked as either:
            a) Refrigerant - High Pressure - Liquid or Hot Gas.
            b) Refrigerant - Low Pressure - Suction, Pumped Liquid Supply or Pumped Liquid Return.

C. Electrical Requirements: Refer to Division 26 for electrical requirements.

D. Painting:
1. All equipment shall be furnished with a factory- applied galvanized, prime paint, or finish paint finish. Touch-up damaged surfaces of equipment immediately.
2. Paint for galvanized surfaces shall be in accordance with ASTM A780 using zinc rich compound.
3. Paint wooden mounting backboards with two coats of gray enamel prior to making attachments to the board.
4. For quality control refer to DIVISION 9 - FINISHES.
5. Remove all dirt, rust, scale, grease, pipe dope, solder flux, and welding slag from all surfaces to be painted.
6. Paint immediately, under this Division, all damaged galvanized surfaces. Paint galvanized metal surfaces behind grilles with two coats of flat black paint.
7. Apply rust inhibitive primer to ferrous surfaces of shop fabricated steel supports.
8. Paint immediately under this division all field and shop welded joints in piping or equipment supports with 2 coats of grey metal primer.
9. All exposed piping shall have a PVC jacket, per ANSI Standard with the following colors:

Chilled Water Supply	Dark Blue
Chilled Water Return	Light Blue
Condensate Piping	Orange
Hot Water Supply	Dark Orange
Hot Water Returns	Light Orange
Glycol Water Supply	Aluminum Jacket
Glycol Water Return	Aluminum Jacket

E. Concrete Work:

1. Concrete pads and curbs for supports of equipment shall be a minimum of 4 inch high with chamfered edges and sized for approved equipment. Furnish drawings to Division 3 Contractor.
2. Surfaces of concrete shall be troweled smooth. When forms are removed, fill voids with cement and rub smooth with rubbing stone.
3. Do not pour concrete when ambient temperature is less than 40-degrees F and falling.

F. Fabricated Steel Supports:

1. Because of the small scale of the drawings, details of equipment support are not always shown. It shall be the responsibility of the contractor to provide supports as required for safe and adequate support.
2. Fabricated steel supports and ladders may be shop or field-fabricated and shall be in accord with details on drawings.
3. When details are not indicated, the contractor shall submit proposed support detail for review. The contractor shall bear all cost in producing this detail in the bid. This includes but is not limited to structural engineering support.
4. Steel members shall be saw cut, with corners ground smooth, and shall be assembled with welded or bolted connections at Contractor's option. Connections shall be in accord with specified AISC Publications.

G. Excavation, Trenching, and Backfilling:

1. Definitions:
   a. Satisfactory material includes all materials except those classified "unsatisfactory", "unyielding" or "unstable".
   b. Unsatisfactory material includes those materials containing roots, organic matter, trash, debris, frozen materials, stones larger than 3 inches in any dimension, and materials classified by ASTM D 2487 as OL, OH, and PT.
   c. Unyielding material consists of rock and gravely soils with stones greater than 3 inches in any dimension, or as defined by the pipe or tank manufacturer, whichever is smaller.
   d. Unstable material consists of material too wet to properly support the pipe or tank.
   e. Select granular material consists of well-graded sand, gravel, crushed gravel, crushed stone, or crushed gravel, crushed stone, or crushed slag composed of hard, tough, and durable particles, and shall contain not more than 10 percent by weight of material passing a No. 200 mesh sieve, and no less than 95 percent by weight passing the 1-inch sieve. The maximum allowable aggregate size shall be 3 inches, or the maximum size recommended by the pipe or tank manufacturer, whichever is smaller.
2. Excavation, trenching, and backfilling for site utility piping systems as specified in DIVISION 31 - SITEWORK.

H. Placing of Equipment:

1. Coordinate setting of equipment with the requirements of other trades so as to avoid conflicts and to ensure compatibility. Equipment shall not block access for installation of other equipment.
2. Set base mounted equipment on permanent and finished supports. Temporary support, if any, shall be removed prior to making final pipe, duct, or electrical connections to equipment.
3. Adjust suspended equipment to final elevation prior to making pipe, duct or electrical connections.

4. Exercise caution during equipment placing operations to ensure that structure is not overloaded.
5. Do not move heavy equipment across floor or roof of insufficient load bearing capacity to support such equipment. Provide bracing or shoring as required or use crane to place equipment directly on permanent and finished support.
6. Secure all roof mounted equipment to the structure adequately to resist overturning, uplift and sliding forces for basic wind speeds indicated for this location in Figure 1609 of the Florida Building Code, Latest Edition.
7. Guards shall be provided where appliances, equipment, fans or other components that require service are located within 10 feet of a roof edge or open side of a walking surface and such edge or open side is located more than 30 inches above the floor, roof or grade below. The guard shall extend not less than 30 inches beyond each end of such appliance, equipment, fan or component and the top of the guard shall be located not less than 42 inches above the elevated surface adjacent to the guard. The guard shall be constructed so as to prevent the passage of a 21-inch diameter sphere and shall comply with the loading requirements for guards specified in the Florida Building Code.

END OF SECTION

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SECTION 23 05 00 - COMMON WORK RESULTS FOR HVAC SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

B. Comply with Sections 01 33 00 - Submittal Procedures and 01 60 00 - Material Equipment and Approved Equals.

1.2 **ARTICLES** INCLUDED

A. Definitions.

B. Permits, Fees and Notices.

C. Applicable Publications.

D. Code Compliance.

E. Scope of Work.

F. Record Drawings.

G. Intent of Drawings and Specifications.

H. Quality Assurance

I. Submittals.

J. Product Requirements Equals and Substitutions.

K. Manufacturer’s Instructions.

L. Transportation and Handling.

M. Storage and Protection.

N. Cutting, Patching and Demolition.

O. Cleaning Up/Removal of Debris.

P. Operating and Maintenance Manuals.

Q. Training of Owners Operators.

R. Guarantee of Work.

S. System Testing.

1.3 ARTICLES

A. Definitions:

1. The term "As indicated" means as shown on drawings by notes, graphics or schedules, or written into other portions of contract documents. Terms such as "shown", "noted", "scheduled" and "specified" have same meaning as "indicated” and are used to assist the reader in locating particular information.
2. The term "Provide", means furnish and install as part of the work covered in Division 23.
3. The term "Furnish" means furnish only, for installation, as part of this contract, by other Divisions.
4. The term "Install only" means to install under the work of Division 23 equipment furnished by other Divisions, or by the Owner.
5. The term "Owner's Representative" when referenced herein shall be the Architect or the Engineer acting as his designated representative unless otherwise noted.
6. The term "design" as it pertains to the work of this division shall describe the basic intent, component sizing, component relationships and overall architecture of the Plumbing

system. The design is generally schematic in nature and will require specific detailing after the accepted products are determined.

7. The term "detail" as it pertains to the work of this division shall describe the work required by the contractor to assure a fully coordinated installation of the material and equipment supplied. When requested, the contractor shall produce detailed shop drawings or sketches indicating the actual placement of the equipment or material supplied; also including how the equipment or material interfaces with work of other sections or divisions within the contract documents.
8. The term "workman-like manner" as it pertains to the work of this division shall describe a neat well-organized high-quality installation system (piping, etc.). Routing shall be well thought out providing adequate service clearance and maximum use of space. Equipment placement shall exhibit proper clearances for service. All lines (piping, etc.) shall be run straight and true, parallel or perpendicular to building structure neatly supported.
9. For additional definitions refer to the General Conditions.

B. Permits, Fees and Notices: Comply with the General Conditions.

C. Applicable Publications:

1. Publications listed in each Section form a part of that Section to the extent referenced.
2. When a standard is specified by reference, comply with requirements of that standard, except when requirements are modified by the Contract Documents, or applicable codes establish stricter standards.
3. The Publication or Standard is the publication in effect as of the bid date, except when a specific date is listed.

D. Code Compliance:

1. Life Safety Code - NFPA 101
2. Florida Building Code 2023
3. Florida Accessibility Code, 2023
4. National Electric Code 2020
5. Florida Mechanical Code 2023
6. State Requirements for Educational Facilities (SREF), 2014
7. NFPA Standards, Latest Edition.

E. Scope of Work: The work to be performed under this Division consists of the satisfactory completion of all HVAC as indicated in the Contract Documents.

F. Record Drawings: Comply with the General Conditions.

G. Intent of Drawings and Specifications:

1. The intent of the drawings and specifications is to establish minimum acceptable quality standards for materials, equipment and workmanship, and to provide operable plumbing systems complete in every respect.
2. Existing conditions, dimensions, etcetera, depicted on the drawings are taken from the "as-built" drawings of the original construction supplemented by field observation. The contractor is cautioned to field verify all existing conditions, dimensions, etcetera, notifying the Owner's Representative of any discrepancies other than those minor in nature, for direction, prior to ordering or fabricating equipment or materials. Anything mentioned in the specifications and not shown on the drawings or shown on the drawings and not mentioned in the specifications, shall be of like effect as if shown or mentioned in both. In case of difference between drawing and specifications, the more stringent shall govern, unless the discrepancy conflicts with applicable codes, wherein the code shall govern.

3. The drawings are diagrammatic, intending to show general arrangement, capacity and location of system components, and are not intended to be rigid in detail. Final placement of equipment, other system components, and coordination of all related trades shall be the contractor's responsibility.
4. Due to the small scale of the drawings, and to unforeseen job conditions, all required offsets and fittings may not be shown but shall be provided at no additional change in contract cost.
5. In the event of a conflict, the Owner's Representative will render an interpretation in accordance with the General Conditions.

H. Quality Assurance:
1. All equipment furnished under this Division shall be listed and labeled by U.L., ETL or a nationally recognized testing laboratory (NRTL).
2. Material furnished under this Division shall be standard catalogued products of recognized manufacturers regularly engaged in the production of such material and shall be the latest design.
3. Materials shall be the best of their respective kinds. Materials shall be new except where the specifications permit reuse of certain existing materials.
4. Work provided for in these specifications shall be constructed and finished in every part in a workmanlike manner.
5. All items necessary for the completion of the work and the successful operation of a product shall be provided even though not fully specified or indicated on the drawings.
6. All work to be performed by qualified and experienced personnel specifically trained in their respective field.
7. All work of this division shall be carefully interfaced with the work of other divisions to assure a complete, functioning system or systems.

I. Submittals:
1. In addition to all other submittal requirements elsewhere in the contract documents, the contractor shall comply with the following.
2. Submittal for acceptance is required only on those items specifically requested in the specification section that applies.
3. For products and equipment that do not require a submittal for acceptance, submit a separate letter for each specification section certifying that all products and equipment will be provided in compliance with the contract documents.
4. Provide submittal data in accordance with the General Conditions and/or as listed below.
5. Designate in the construction schedule, or in a separate coordinated schedule, the dates for submission and the dates that the submittals will be needed in order to meet construction schedule. This schedule shall be submitted prior to or in conjunction with the first submittal. Processing of submittals may be delayed pending the receipt of this schedule at the reviewer’s discretion.
6. Submittal data shall be presented in a clear and thorough manner and referenced to the specification section.
    a. Where applicable, data shall be identified by reference to sheet and detail, schedule or room numbers, equipment or unit number as shown on Contract Drawings.
7. Prepare performance and product data as follows:
    a. Clearly mark each copy to identify pertinent products or models, delete non-pertinent data.
    b. Show performance characteristic and capacities.

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c. Show dimensions and clearances required.

d. Show wiring or piping diagrams and controls.

e. Clearly list any deviation in the submittals from the requirements of the contract documents.

f. Include installation requirements.

8. Manufacturer's standard schematic drawings and diagrams:
   a. Modify drawings and diagrams to delete information not applicable to the work of this project.
   b. Supplement standard information to provide information specifically applicable to the work of this project.
9. Prohibition of Asbestos and PCB:
   a. The use of any process involving asbestos or PCB, and the installation of any product, insulation, compound of material containing or incorporating asbestos or PCB, is prohibited. The requirements of this specification for complete and operating mechanical systems shall be met without the use of asbestos or PCB.
   b. Prior to the Final Review field visit the Contractor shall certify in writing that the equipment and materials installed in this Project under this Division 22 contain no asbestos or PCB. Additionally, all manufacturers shall provide a statement with their submittal that indicates that their product contains no asbestos or PCB. This statement shall be signed by a duly authorized agent of the manufacturer.
10. Letter of Certification: Where a submittal is not required, provide letter certifying that the work will be completed in strict accordance with the specified requirements. In the event the contractor wishes to alter the requirements of the specification for whatever reason, this should be clearly explained in this letter noting that this alteration may require additional submittal requirements.
11. Schedules: Where schedules are called for, submit schedule indicating which products will be used and to what extent by system, location, size, etc.
12. Where samples are requested, samples shall be of sufficient size and quantity to clearly illustrate:
    a. Functional characteristics of the product, with integral related parts and attachment devices.
    b. Full range of color, texture and pattern.
    c. Where a mock-up is specified, erect at the Project site, in a location acceptable to the Owner's Representative. Size or area shall be that specified or as agreed upon during pre-construction or other job site meetings.
    d. Where mock-up is not a permanent part of the installation, remove mock-ups at conclusion of work or when acceptable to the Owner's Representative.
13. The Contractor shall:
    a. Review Shop Drawings, Product Data and Samples prior to submission.
    b. Determine and verify:
       i. Field measurements.
       ii. Field construction criteria.
       iii. Catalog numbers and similar data.
       iv. Conformance with specifications.

v. All submittals have been properly interfaced with the requirements of this and other divisions of work so as to assure a complete, functioning system in accordance with the contract documents.

vi. Provide 1/4 inch drawings of ALL mechanical rooms, with dimensions clearly indicating equipment maintenance clearances and electrical NEC required clearances. NO mechanical room walls shall be built until the engineer and the owner have approved the shop drawings for the mechanical equipment and clearances.

c. Coordinate each submittal with requirements of the work and of the Contract Documents. Clearly identify any deviations in the submittals from requirements of the Contract Documents. Any deviations not specifically disclosed in the submittal shall be solely at the risk of the Contractor and shall be subject to discovery at any time. Any undisclosed deviations shall be corrected by the Contractor to comply with the requirements of the Contract Documents at no cost to the Owner regardless of the action code accorded the submittal by the Owner's Representative.

d. Do not release equipment for shipment, begin fabrication or work on any items requiring submittals for acceptance until all submittals are returned with the Owner's Representative acceptance.

e. Make submittals promptly, and in such sequence as to cause no delay in the work or in the work of any other contractor.

14. Number of Submittals: Comply with the Division 1, Specification Section 01 33 00 – Submittal Procedures.

15. Submittals shall contain:

a. The date of submission and the dates of any previous submissions.

b. The Project title and number.

c. Contract identification.

d. The names and phone numbers including personal contact of:

i. Contractor.

ii. Supplier.

iii. Manufacturer.

e. Identification of the product, with the specification section number and contract document description clearly indicated.

f. Field dimensions clearly identified as such.

g. Relation to adjacent or critical features of the work or materials.

h. Applicable standards.

i. Identification of deviations from Contract Documents.

j. Identification of revisions on re-submittals.

k. Contractor's stamp, initialed or signed, certifying to review of submittal, verification of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.

l. Each submittal shall be limited to a single specification section. Submittals shall not be grouped with other sections in common binders or under common control sheets except as defined in paragraph m. below. Each submittal shall have a cover/control sheet containing the information listed above (a thru k) and have a minimum of 8" x 3" clear space for the general contractors, engineers and architects review stamp.

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m. The first group of submittals shall be sent in a minimum of one (or if required) two hard cover view type 3-ring binder(s) White, sized to hold 8-1/2" x 11" sheets:
   i. Binder is to be adequately sized to comfortably hold required submittals. Minimum spline size to be 1", maximum spline size to be 3" (provide additional binders if 3" size is not sufficient to properly hold submittals).
   ii. Binder cover and spline to have outer clear vinyl pockets. Provide correct designation of project in each pocket. Description sheets are to be white with black letters, minimum of 11" high and full width of pocket. Description is to describe project and match project drawing/project manual description.

n. Submittals not complying with these requirements may be returned with no action taken at the reviewer's discretion.

16. Re-submittals shall contain:
   a. The date of re-submission and the dates of all previous submissions.
   b. A copy of the Engineer's comments from the previous submittal.
   c. An itemized response to each of the Engineer's comments specifically outlining the changes or corrections being made. As an example, this could be either noting the page(s) of the previous submission that are affected and what changes have been made or noting specific additional information being provided.
   d. Submittals not complying with these requirements may be returned with no action taken at the reviewer's discretion.
   e. Turnaround time and copies as indicated in Section 01 33 00 - Submittal Procedures.
17. The Owner's Representative will (if they so desire):
   a. Review submittals promptly and where special attention is requested, review in accordance with the schedule required.
   b. Review the submittal for general compliance with the contract documents. The contractor is responsible for quantities, dimensions, placement of the product, coordination with all other trades occupying the space, maintain service clearance, function and compliance with the written installation instructions.
   c. Determine the appropriate action for the submittal. Action codes will be as follows:
      i. "NO EXCEPTIONS TAKEN" - Copies will be distributed as indicated under above schedule.
      ii. "NOTE MARKINGS/CONFIRM" - Final but Restricted Release; General Contractor may proceed with fabrication, taking into account the necessary corrections on submittal and with Contract Documents. General Contractor must submit a confirmation letter to remove restriction and allow shop drawings on the project site. A sample of a confirmation letter is enclosed herein.
      iii. "NOTE MARKINGS/RESUBMIT" - General Contractor may proceed with fabrication, taking into account the necessary corrections. Corrected shop drawings shall be resubmitted before fabrication of this work is complete to obtain a different action marking. Do not allow drawings marked "Resubmit" to be used in connection with installation of the Work.
      iv. "REJECTED/RESUBMIT" - General Contractor will be required to resubmit shop drawings in their entirety. No fabrication or installation shall be started until shop drawings so marked have been completely revised, resubmitted, and marked by Architect according to preceding Paragraphs a. or b.
   d. Turnaround time will be per Division 1.
   e. Review comments will be per Division 1.

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18. Resubmission requirements for "as specified" products.
    a. Make any corrections or changes in the submittals required by the Owner's Representative and resubmit until accepted.
    b. A submittal shall only be reviewed a maximum of 3 times. If upon the second resubmission an accepted action cannot be rendered (No Exceptions Noted or Make Corrections as Noted), the contractor shall supply the basis of design product and bear all costs incurred by the Owner's Representative during the review process until an accepted submittal is achieved.
19. The Contractor shall maintain one copy of all accepted submittal data including letters of compliance in a job site file.

J. Product Requirements, Equals and Substitutions: Comply with the General Conditions, but the following are in addition to:
1. In addition to all other requirements for submittals, equals and substitutions elsewhere in the contract documents, the contractor shall comply with the following:
2. Product Requirements:
    a. The specifications sections under Article 2.1 "ACCEPTABLE MANUFACTURER", lists suppliers found acceptable for this project. The names listed are manufacturers who meet the minimum acceptable standards that this project dictates. The list is furnished as a guide. Even though a manufacturer is named, he must still provide the type and quality of equipment specified as well as equipment that will fit within the allotted space and within the design weight allowance, etc. Being named does not imply permission for that manufacturer to provide an alternative product or design. Other manufacturers not named will be considered to be equal providing they furnish a product of the type and quality specified.
    b. In certain cases, foundations and/or structural supports or electrical requirements for equipment specified in this Division are provided under other divisions of the specifications. Where an alternate acceptable manufacturer's product is provided, this contractor shall coordinate the revised requirements and include an allowance for any cost differential.
    c. If the list, under Article 2.1 "ACCEPTABLE MANUFACTURERS" names only one manufacturer followed by "No Substitutions" that product shall be supplied.
3. Substitutions: Comply with the General Conditions, but the following are in addition to:
    a. A substitution is defined as any product not meeting the requirements as outlined in PART 2 - PRODUCTS. A different design accomplishing the same result will be considered a substitution. The same design requiring a larger motor, or more space or a structural change to accommodate larger weight, etc., will be considered a substitution. If a manufacturer who is not listed as an "ACCEPTABLE MANUFACTURER" wants to have his product considered as an equal or as a substitution, he shall submit details to the Engineer 10 days in advance of bid date and a decision will be rendered. If necessary, a clarification will be issued in the form of an Addendum. No substitution requests shall be considered after the Bid.
    b. Submit a separate request for each product, supported with complete data, with drawings and samples as appropriate, including.
        i. Comparison of the qualities of the proposed substitution with that specified in tabulated format.
        ii. Changes required in other elements of the work because of the substitution.
        iii. Effect on the construction schedule.
        iv. Cost, extra credit or statement of no change in contract price.

v. Any required license fees or royalties.

vi. Availability of maintenance service, and source of replacement materials.

c. The Engineer shall be the judge of the acceptability of the proposed substitution.

d. A request for a substitution constitutes that the Contractor:

i. Has investigated the proposed product and determined that it is equal to or superior in all respects to that specified.

ii. Will provide the same warranties for the substitution as for the product specified.

iii. Will coordinate the installation of the substitution into the work, and make such other changes as may be required to make the work complete in all respects.

iv. Waives all claims for additional costs, under his responsibility, which may subsequently become apparent.

v. Will absorb all costs incurred by the substitution when affecting other trades including but not limited to electrical, structural, architectural, etc.

vi. Will absorb any cost incurred by the Engineer in review of the substituted product if the acceptance of the substituted item creates the need for system modification and/or redesign, or if the substituting contractor exhibits negligence in his substituting procedure thus submitting inferior, misapplied or mis-sized equipment. In the event of additional engineering costs, the billing structure shall be agreed upon prior to review by all involved parties.

4. Engineer will review requests for substitutions with reasonable promptness, and will issue an addendum or notify Contractor, in writing, of the decision to accept or reject the requested substitution.

5. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or if acceptance requires revision to the contract documents.

6. The engineer will review substitution submittals for compliance a maximum of two times. If the submittal or substituted product does not comply with the contract documents on the second submittal, the submittal and product will be rejected and the specified product will be required.

7. The contractor may request further review of the substitution after the second submittal rejection if the contractor agrees in writing to accept responsibility for the cost of additional review time and expenses by the Engineer.

8. In the event a substitution is rejected, supply the products which constituted the basis of design at no change in the contract price.

9. Installation of substitutions without the Owners approval shall be cause of immediate rejection and removal without extra cost to the Owner.

K. Manufacturer's Instructions:

1. Installation of work shall comply with manufacturer's printed instructions.

2. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with Engineer for clarification. Do not proceed with work without clear instructions.

L. Transportation and Handling: Comply with General Conditions.

M. Storage and Protection:

1. Store products in accord with manufacturer’s instructions, with seals and labels intact and legible.

2. Store products to prevent damage by the elements. Space temperature shall be controlled as required to prevent condensation and metal corrosion or damage to electrical or electronic parts are the result of condensation.

3. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions, and free from damage or deterioration.
4. Provide protection as necessary to prevent damage after installation.
5. Products which suffer damage due to improper storage shall not be installed and if found in place, shall be removed and replaced at the contractor's expense.

N. Cutting and Patching: Comply with the General Conditions.

O. Cleaning Up/Removal of Debris:
1. Comply with the General Conditions.
2. Maintain a clean work area. Construction debris shall be immediately removed from all newly erected work.

P. Operating and Maintenance Manuals: Comply with the General Conditions, but the following are in addition to:
1. Quantity: Comply with the General Conditions.
2. Format: Adequately sized for contents, minimum 1 inch and maximum 3 inch spline size, hard cover, view type, 8-1/2" x 11 loose leaf binders. Binder covers to have outer clear vinyl pocket on front cover and spline. Provide correct project designation and contents description in each pocket. Use as many as required. Do not overload binders.
3. Content:
   a. Cover sheet.
   b. Table of contents (as follows):
      i. Description of systems.
      ii. Design parameters.
   c. Point by Point System Check-out: Provide tabulated results indicating compliance with contract document requirements.
4. Detailed Preparation Requirements:
   a. The cover sheet shall list project name, location, architect, structure engineer, mechanical engineer and electrical engineering firm name with address, telephone number and project manager's name for this project.
   b. Each major heading in the table of contents shall have a large distinctive, clearly marked, non-erasable, plastic encased tab.
   c. The description of systems will be provided by the design engineer for insertion at the time of review and turn-over to owner. This description of systems will be an updated version of the narrative included in this Section and will be an overview of the entire system. It will be the basis for the starting of the owner's instruction program.
   d. Each section shall have the following sub-tabs. Sub-tabs shall be similar to the main tabs but of a different color.
      i. Specifications: The specification shall be copied and inserted complete with all addenda.
      ii. Submittal: This section shall include all accepted submittal data. If submittal was not required, include technical data as specified.
      iii. Installation Instructions: If the product, such as pipe, etc., does not have any written installation instructions, include a statement "Manufacturer's Written Installation Instructions Not Available - Product Installed in Accordance with Specifications and Good Practice".
      iv. Operation and Maintenance Instructions: These shall be the written

manufacturer's data edited to omit reference to products or data not applicable to this installation.

v. Parts List: These shall be edited to omit reference to items not applying to this installation.

vi. Equipment Supplier: This section shall include the name, address and telephone number of the manufacturer's agent and/or service agency supplying or installing and starting up of the equipment.

vii. System Description: This section shall include that portion of the overall description included in the beginning of the manual as it applies to each sub-section. In sections such as pipe, valves and fittings, a statement shall be included "Not Applicable to this Section." Data for this section will be added by the design engineer when the manuals are submitted for review and forwarded to the owner.

Q. Training of Owners Operators: (Refer to Appendix A)

1. The manufacturer shall provide a comprehensive training outline for the Owner & Engineer to review within 90 days of final completion.
2. The manufacturer & contractor shall provide 24 hours of training on the plumbing system, plumbing fixtures, and all water heating systems.
3. The owners shall be given comprehensive training in the understanding of the systems and the operation and maintenance of each major piece of equipment.
4. The contractor shall be responsible for scheduling the training which shall start with classroom sessions followed by hands on training on each piece of equipment. Hands on training shall include start-up, operation in all modes possible, shutdown and any emergency procedures. The manufacturer's representative shall provide the instructions on each major piece of equipment. These sessions shall use the printed installation, operation and maintenance instruction material included in the O&M manuals and shall emphasize safe and proper operating requirements and preventative maintenance.

R. Guarantee of Work:

1. Comply with the General Conditions.
2. Where applicable, furnish manufacturer's written warranty for materials and equipment.
3. Insert warranties in appropriate locations in operating and maintenance manuals.
4. Materials and equipment having seasonal operation limitations shall be guaranteed for a minimum of one year from date of seasonally appropriate test, and acceptance in writing by the Owner, unless specific Division 23 specifications specify a longer period.

S. System Testing:

1. Provide all necessary labor, materials and equipment to successfully complete all system testing necessary for building occupancy and owner acceptance.
2. Provide all necessary labor, materials and equipment to assist contractors of other division to complete system testing necessary for building occupancy and owner acceptance, wherever an inter-relationship between Division 23 and the work of other divisions exists.
3. Tests shall be repeated as necessary until all occupancy and operation permits are granted and the owner accepts the project.

4. Testing schedule requirements per the Table below:

Training Schedule							
Div.	Training Description	Sub-contractor	Demo. Date	Time	Hours	Comments	Personnel to attend training
	Energy Management System				40 hours	On the job owner training conducted by a technician fully qualified to conduct such training.	
	HVAC Systems				80 hours	Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units. See specifications for complete list of training requirements.	
	Chillers/ Packaged Pumping Equipment				2-8 hour	Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units. See specifications for complete list of training requirements.	

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

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SECTION 23 05 13 - MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

B. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Starters for all motors furnished under this Division, except where starters are provided in a motor control center by Electrical Specifications or where motors require adjustable frequency drives.

B. Motors for equipment furnished under this section.

1.3 SUBMITTALS

A. Motor Starters:
   1. Submission for acceptance is required. Provide a schedule indicating duty, motor HP, starter size and heater size.
   2. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

B. Motors:
   1. Submission for acceptance is required. All three phase motors are based on NEMA Premium™ efficiency motors as described below by the minimum allowable efficiency. As a result, all motor starting codes are based on Code letter F or greater as defined by NEC Article 430. In the event that a manufacturer provides a motor with a code letter less than F, the overcurrent protection of the motor shall be coordinated with the Electrical Contractor to comply with NEC Article 430.
   2. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

1.4 APPLICABLE PUBLICATIONS

A. NEMA Publication ICS.

B. NEMA Publications MG-1, MG-2, MG-13.

1.5 QUALITY ASSURANCE

A. All starters to be standard product of single manufacturer.

B. Motor efficiencies in accordance with IEE Standard 112 Method B as defined by NEMA MG1-1.23, a. and b.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Starters:
   1. Allen Bradley
   2. Cutler Hammer
   3. General Electric
   4. Siemens
   5. Square D
   6. Engineer-approved Equal

B. Motors:
   1. A.O. Smith/Century E-Plus

2. Baldor Electric Company, Premium Efficiency.
3. Emerson Electric Company, U.S. Electrical Motors Div., Premium Efficiency Type 'DE' & 'RE'.
4. The Louis Allis Company, High Efficiency.
5. General Electric Company, Premium Efficiency Energy Saver®
6. Reliance Electric Manufacturing Company, XE™ Premium Efficiency Motors.
7. Engineer-approved Equal

2.2 FABRICATION - MOTOR STARTERS

A. Starters - Full Voltage, Single Speed, Magnetic:

1. Full voltage, non-reversing magnetic as scheduled.
2. 3 phase, 60 Hz, voltage as scheduled.
3. Electronic overload relay protection in all phases.
4. Manual reset in cover.
5. Under voltage release.
6. Hand-off-automatic selector switch.
7. Red and green panel lights that are multi-LED style. Full voltage lamps are not acceptable.
8. Size to suit motor being controlled.
9. Control transformer for 120-volt control, fused and grounded in accordance with NEC.
10. Non-fused disconnect switch.
11. Starters located indoors to have NEMA 1 General Purpose Enclosure. Starters located outdoors or in unheated spaces to have NEMA 3R watertight and dust tight enclosure.
12. Solderless lugs.
13. Two N.O. auxiliary contacts.
14. Starter for all motors shall include three-phase power monitor as manufactured by Time Mark Corporation Model 258 or equal, providing solid state protection by opening starter for loss of any phase, low voltage of any or all phases, and phase reversal. Monitor shall be field adjustable for drop-out voltage. Monitor shall be UL recognized.

B. Starters - Reduced Voltage - Part Winding:

1. Reduced voltage, part winding, magnetic for 50-50 winding split.
2. 3 phase, 60 Hz, voltage as scheduled.
3. Electronic overload relay protection in all six leads.
4. Manual reset in cover.
5. Under voltage release.
6. Hand-off-automatic selector switch.
7. Red and green panel lights that are multi-LED style. Full voltage lamps are not acceptable.
8. Minimum size NEMA 1.
9. Control transformer for 120-volt control, fused and grounded in accordance with NEC.
10. Non-fused disconnect switch.
11. Starters located indoors to have NEMA 1 General Purpose Enclosure. Starters located outdoors or in unheated spaces to have NEMA 3R watertight and dust tight enclosure.
12. Solderless lugs.
13. Two N.O. auxiliary contacts.

14. Set electronic overload relays for 50% of rated full load current.
15. Starter for all motors shall include three-phase power monitor as manufactured by Time Mark Corporation Model 258 or equal, providing solid state protection by opening starter for loss of any phase, low voltage of any or all phases, and phase reversal. Monitor shall be field adjustable for drop-out voltage. Monitor shall be UL recognized.

C. Starters - Two Speed - One Winding:
1. Full voltage, non-reversing, magnetic.
2. 3 phase, 60 Hz, voltage as scheduled.
3. Variable torque.
4. Electronic overload relay protection for each phase and for each speed.
5. Manual reset in cover.
6. Under voltage release.
7. Fast-slow-off-auto selector switch.
8. Adjustable time deceleration for transition from high to low speed.
9. Pilot lights that are multi-LED style. Full voltage lamps are not acceptable.
10. Control transformer for 120 V control, fused and grounded in accordance with NEC.
11. Non fused disconnect switch.
12. Starters located indoors to have NEMA 1 General Purpose Enclosure. Starters located outdoors or in unheated spaces to have NEMA 3R watertight and dust tight enclosure, except that starters located in cooling tower enclosures shall be NEMA 3R.
13. Solderless lugs.
14. Two N.O. auxiliary controls per speed.
15. Starter for all motors shall include three-phase power monitor as manufactured by Time Mark Corporation Model 258 or equal, providing solid state protection by opening starter for loss of any phase, low voltage of any or all phases, and phase reversal. Monitor shall be field adjustable for drop-out voltage. Monitor shall be UL recognized

D. Manual Starters:
1. Bi-metal type thermal overload protection in all phases of type to cause switch handle to assume mid position on overload.
2. Quick break operating mechanism and silver contacts.
3. Pressure type terminals.
4. Mechanism trip free so contacts cannot be reclosed until bimetallic strip cools.
5. Starters located indoors to have NEMA 1 General Purpose Enclosure. Starters located outdoors or in unheated spaces to have NEMA 3R watertight and dust tight enclosure.
6. Manual starters for three phase motors shall utilize a full voltage single speed, magnetic starter as specified in paragraph 2.2-A. A toggle switch shall be provided to facilitate the manual control specified of the magnetic starter.

2.3 FABRICATION - MOTORS

A. 3/4 HP and Larger Horsepower Motors:

1. NEMA Premium™ efficiency type having the following minimum efficiencies:

Minimum Nominal Full-Load Motor Efficiency (%)						
	Open Motors			Totally Enclosed		
Number of Poles	2-Pole	4-Pole	6-Pole	2-Pole	4-Pole	6-Pole
Speed (RPM)	3600 RPM	1800 RPM	1200 RPM	3600 RPM	1800 RPM	1200 RPM
HP						
0.75	---	85.5	---	---	85.5	---
1	82.5	85.5	82.5	77.0	85.5	82.5
1.5	84	86.5	86.5	84.0	86.5	87.5
2	85.5	86.5	87.5	85.5	86.5	88.5
3	85.5	89.5	88.5	86.5	89.5	89.5
5	86.5	89.5	89.5	88.5	89.5	89.5
7.5	88.5	91	90.2	89.5	91.7	91.0
10	89.5	91.7	91.7	90.2	91.7	91.0
15	90.2	93	91.7	91.0	92.4	91.7
20	91	93	92.4	91.0	93.0	91.7
25	91.7	93.6	93	91.7	93.6	93.0
30	91.7	94.1	93.6	91.7	93.6	93.0
40	92.4	94.1	94.1	92.4	94.1	94.1
50	93	94.7	94.1	93.0	94.5	94.1

7. Drip proof, except motors located outdoors to be TEFC or as otherwise specified.
8. Continuous duty, 40-degrees C ambient.
9. Regreasable ball bearing design.
10. Speed/Torque curves shall be NEMA Design B so that overload protection provided by standard motor starters will be adequate to prevent over-heating during stall or slightly prolonged motor acceleration.
11. Class B insulation, except motors for variable speed drive application to be specially built for Adjustable Frequency Drive (AFD) duty and include Class F insulation and be suitable for operation down to 10% on fan and pump applications.
12. Assembly to meet application.
13. 1.15 service factor.
14. Suitable for starter type as scheduled on drawings or in Specification Section 15056 – Motor Starters.
15. Slide bases as required.
16. 60 Hz. terminal box large enough to accommodate the required conduit and wiring.
17. 200-, 208-, 230- or 460-volt, 3 phases as scheduled.

B. Fractional Horsepower Motors:

1. Permanent split capacitor.
2. 115-volt, 1 phase, 60 Hz.
3. Thermally protected.

4. Other features of motors supplied as an integral part of a factory assembly shall be acceptable as the manufacturer's standard based on acceptance of the assembly as a whole.

PART 3 - EXECUTION

3.1 GENERAL

A. Furnish starters for all motors furnished under Division 23 except where starters are provided in motor control center by Division 26.

B. Receive, unload and deliver starters to electrical contractor on job-site for storage, uncrating and installation by Division 26.

C. Furnish all necessary wiring diagrams to Division 26 for installation and power wiring.

D. Starter Schedule:

1. All motors up to and including 40 HP at 460 V or 20 HP at 200V shall be provided with full voltage starters.
2. Motors over 40 HP at 460V or 20 HP at 200V shall be provided with reduced voltage starters, either part-winding or auto-transformer.
3. Single phase motors requiring automatic start/stop to be provided with manual starter and controlled by pilot relay.
4. Cooling tower motors, where specified to be two speed shall be two-speed: one winding type.
5. Pump and fan motors listed as adjustable or variable speed to be controlled by adjustable frequency drive units specified in Section 23 05 17.

E. Starters to be mounted where indicated on the drawings or within sight of the motor controlled.

F. Starters may be mounted directly to masonry, CMU or concrete walls using appropriate fastening methods. When the wall is an exterior wall or any wall where condensation may occur, provide appropriate stand-off, i.e., Unistrut channel).

G. Starters may be mounted directly to equipment such as factory or field-built AHU. In this case, through bolts and backing plates along with an appropriate stand-off shall be used. Seal all holes. Self-tapping screws with exposed ends will not be acceptable.

H. When starters are required to be located in areas where walls are not available, provide a Unistrut type frame securely mounted to floor adequately braced to form a rigid mounting surface.

I. Starters shall be generally mounted with the center of the unit at 60" above the finished floor. Service clearance shall be provided in accordance with the National Electric Code and under no circumstances less than the following:

Voltage to Ground	Minimum Clearance Distance
110V or 120V	3'-0"
208V, 220V, 240V or 277V	3'-6"
460V or 480V	4'-0"
Greater than 480V	5'-0"

J. Starters shall be accessible.

K. Provide housekeeping pad for all floor mounted starters.

3.2 MOTORS - INSTALLATION

A. Motors:

1. Install in accordance with requirements of the duty.
2. Lugs to be provided under this Division.

3. All motors shall have overload protection as required by NEC. Any motor without integral protection shall have a starter that provides overload protection furnished by Division 23.

END OF SECTION

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SECTION 23 05 17 - ADJUSTABLE FREQUENCY DRIVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

B. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Adjustable frequency drive units (AFD) for all motors identified as operating at variable speed.

1.3 QUALITY ASSURANCE

A. All adjustable frequency drives and bypass assemblies and control panel enclosures must be the product of a single manufacturer.

B. AFD shall be UL or ETL listed. Components used in all options shall be UL listed. The entire AFD and bypass assembly shall be U.L. marked with a short circuit current rating of at least 100,000 amperes. The VFD short circuit rating shall be posted in the operating instructions or on the product label. This shall be in compliance with the UL listing and rating requirement.

C. The AFD shall be designed to meet the power line transient conditions defined within ANSI/IEEE C62.41-1991 and shall have a voltage withstand rating of 6 KV in accordance with UL 1449.

D. AFD shall be in certified for with FCC emission limits for Class A computing devices. If required to meet these limits, isolation transformers, and/or line filters shall be provided.

E. Ambient noise generated by the AFD shall be limited to an amount equal to 3 dbA greater than the fan or pump system noise level at design rpm. If acoustic enclosures are required to meet these limitations provide same with the AFD.

F. AFD manufacturer shall submit an analysis to certify that the drive, when installed in the electrical distribution system shown on the Contract Documents is in compliance with the requirements of IEEE 519 - 1992. The Point of Common Coupling (PCC) shall be defined as the secondary lugs of the Utility Company Transformer. The transformer impedance shall be 5.75% with the appropriate short circuit current based on this value.

G. AFD and option design and construction thereof shall comply with all applicable provisions of the latest National Electrical Code.

H. Power components shall undergo burn in to ensure product function. Circuit boards shall be tested under thermal cycling and the complete unit shall be tested under full load conditions to ensure maximum product reliability.

I. A Factory Authorized Service Engineer is to be provided for start up which shall include verification of proper installation and wiring. Inspect all components, circuit boards and control wiring. Ensure proper power source and control signal. Apply power and provide full operational testing and calibration. Also provide a minimum of 16 hours training for Owner’s operators.

J. Provide full 5 year on-site parts and labor warranty including travel time and expense. Warranty period shall begin at date of final completion.

K. AFD’s shall be fully protected during the duration of construction of the project. Units shall be covered to protect from all dirt, dust and debris. Contractor will be responsible for replacing any unit that has dirt, dust or debris infiltration into the unit.

L. The supplier shall offer a service support group which shall be able to provide the following additional services; not included in this contract:

1. Emergency service calls.

2. Overnight service parts.
3. Service contracts.
4. In-plant training of client personnel in basic troubleshooting.
5. Coordinate enrollment of client personnel in factory-held service schools.

1.4 SUBMITTALS

A. Submission for acceptance is required. Submittal shall show compliance with all paragraphs and statements listed in part 2 below.

B. A complete harmonic analysis showing compliance with IEEE 519 - 1992 shall be provided with the submittal as defined in paragraph 1.3 above.

C. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

D. Submit in accordance with Division 1 requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Adjustable Frequency Drive Units:

1. ASEA Brown Bovari (ABB)
2. Century (MagnaTek)
3. Cutler Hammer
4. Danfoss/Graham
5. Square D
6. Toshiba
7. Trane
8. Engineer-approved Equal

2.2 EQUIPMENT REQUIREMENTS

A. Adjustable Frequency Drive:

1. The adjustable frequency drive shall convert either 208/230 or 460 volt ±10%, three phase, 60 HZ (± 2 HZ) utility power to adjustable voltage/frequency, three phase, AC power for stepless motor control from 5% to 105% of base speed.
2. The adjustable frequency drive (AFD) shall produce an adjustable AC voltage/frequency output for complete motor speed control using transistorized sine coded PWM technology, and an input power factor near unity over the entire speed range. The AFD shall not produce excessive or objectionable motor acoustical noise. The AFD shall not induce voltage line notching back to the utility line and total harmonic distortion (THD) shall not exceed the limits set in IEEE Std. 519 -1992 when installed in the electrical distribution system shown on the Contract Documents. The AFD shall be automatically controlled by a grounded electronic control signal.
3. The AFD shall be self contained, totally enclosed in a NEMA 1 ventilated cabinet and capable of operation between 0° and 40°C except where located outdoors enclosure to be NEMA 3R or 4X watertight and dust-tight enclosure, depending on the manufacturers offering. The entire AFD assembly shall be mounted in a common enclosure requiring only a power in and a power out connection.

4. The AFD maximum output current rating shall be as follows:

Horsepower (HP)	FLA @ 208V	FLA @ 460V
5	16.7	7.6
7-1/2	24.2	11.0
10	28.0	14.0
15	46.2	21.0
20	59.4	27.0
25		34.0
30		40.0
40		52.0
50		65.0
60		77.0
75		99.0
100		124.0

5. AFD shall be a minimum of 97% efficient at 100% rated output power, 60 HZ.
6. The AFD shall have the following basic features:
   a. Operator control interface.
      i. Hand/Off/Auto operator switch.
      ii. Panel mounted digital display capable of indicating unit status, frequency and fault diagnostics, including overcurrent, overvoltage, overheating, ground fault or short circuit.
   b. Electronic control follower board, 0-5 VDC, 0-10 VDC or 4-20 mA or 0-135 ohms (coordinate requirement with controls contractor).
   c. Minimum/maximum adjustable speeds (Minimum speed factory set at 12 HZ, maximum speed factory set at 60 HZ, may vary based on application).
   d. Manual speed potentiometer control for use when AFD is in manual control mode.
   e. Adjustable linear timed acceleration and deceleration for soft starting/stopping (adjustable from 1-300 sec) recommended range 20-60 seconds depending on inertial load. Factory set at 60 seconds.
   f. 3-80 HZ controlled speed range (factory set at maximum frequency of 60 HZ).
   g. Output terminals for remote frequency meter and ammeter.
   h. RFI/EMI filter.
   i. Manual bypass circuit with three contactors to provide full speed starter operation for motors 100 HP and less and an electronic, solid state, full-wave, soft-start controller for all motors 125 HP and larger for operation in the event of AFD electronics failure complete with disconnect and overload protection in all three phases. Provide a three-phase power monitor as manufactured by Time Mark Corporation Model 258 or equal, providing solid state protection by opening starter for loss of any phase, low voltage or any or all phases, and phase reversal. Monitor shall be field adjustable for drop-out voltage. Monitor shall be UL recognized.
   j. Line circuit breaker disconnect (door-interlocked) with current limiting fuses on the line side of the circuit breaker having a minimum AIC rating of 200,000 Amps. The disconnect switch shall have a minimum short circuit rating of 100,000 amps.
   k. Provide line impedance reactors to the power line to reduce the total harmonic distortion (THD) level to that allowed by IEEE 519-1992. If the harmonic distortion level required by IEEE 519-1992 can be met without these devices, they may be omitted.

l. Isolation transformer with electrostatic shields for optimum noise protection and phase shifting capability shall be provided where the addition of line impedance reactors will not lower the total harmonic distortion (THD) level to that allowed by IEEE 519 - 1992. If the harmonic distortion level required by IEEE 519 - 1992 can be met with only line reactors, then phase shifting isolation transformers may be omitted.

7. The AFD controller shall include the following protective circuits/features:
   a. Current limit shall be provided at 100% of the motor FLA. If current exceeds 100% of the motor current, the AFD will slow down the motor. If the current continues to rise the AFD shall shut down on overcurrent. Current limit will be adjustable by qualified service personnel for application of AFD to smaller than nameplate motors.
   b. Current limit/soft stall feature - current limit/soft stall allows continuous operation while in an overload condition. It limits the current by slowing down the frequency. The soft stall feature will be field set and the current limit adjusted to 100% of the motor FLA or drive FLA whichever is smaller.
   c. Instantaneous electronic trip - automatically safely shutdown motor if:
      i. Current exceeds 200% of design.
      ii. Phase-to-phase output short circuit occurs.
      iii. Phase-to-ground output short circuit occurs.
      iv. Phase loss occurs.
   d. The AFD shall be programmable to provide restart automatically, if desired, when input line returns to normal in the event of:
      i. Intermittent power outage.
      ii. Phase loss.
      iii. Overvoltage shutdown.
      iv. Intermittent voltage spike.
   e. Insensitive to incoming power phase.
   f. Line-to-line fault protection.
   g. Line-to-ground short-circuiting and accidental motor grounding protection.
   h. Electronic overload protection.
   i. Over-temperature protection.
8. The AFD shall be designed and constructed to operate within the following service conditions:
   a. Elevation up to 3300 feet without derating.
   b. Ambient temperature range - 0°C to 40°C.
   c. Atmosphere – non-condensing relative humidity to 90%.
   d. AC line voltage variation - 10% to +10%.
   e. AC line frequency variation ± 2 HZ.
9. Bases of Design: Danfoss FC102 or Trane TR200.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Adjustable Frequency Drive:
   1. Furnish adjustable frequency drive for each motor identified as requiring an adjustable frequency drive or variable speed operation.

2. Receive, unload, and deliver drives to electrical contractor on jobsite for storage, uncrating and installation by Division 26.
3. Furnish all necessary wiring diagrams to electrical contractor for installation and power wiring.
4. Coordinate the purchased equipment with the motor served and with the automatic temperature control system, paying specific attention to the signal sent and received and the ground source.
5. Start-up shall be by a factory trained field service engineer. Start-up shall be done with the cooperation of the control's contractor. The minimum speed shall be set for 20% at the AFD. The control signal shall be full scale so that the minimum speed will be 20% (adjustable).
6. AFD to be mounted where indicated on the drawings or within sight of the motor controlled.
7. Where a remote disconnect is provided for a motor controlled by an adjustable frequency drive, coordinate with the supplier of the disconnects to ensure that a late make, early break auxiliary contact rated for ten amps continuous duty is provided on the disconnect. This auxiliary contact must be wired into the AFD start circuit to ensure shutdown of the AFD in the event of the disconnect being opened.
8. AFD may be mounted directly to masonry, CMU or concrete walls using appropriate fastening methods, including back plates. When the wall is an exterior wall or any wall where condensation may occur, provide appropriate stand-off, i.e., (Uni-strut channel).
9. AFD may be mounted directly to equipment such as factory or field-built AHU. In this case, through bolts and backing plates along with an appropriate stand-off shall be used. Seal all holes. Self-tapping screws with exposed ends will not be acceptable.
10. When AFD is required to be located in areas where walls are not available, provide a Unistrut type frame securely mounted to floor adequately braced to form a rigid mounting surface.
11. AFD shall be generally mounted with the center of the unit at 60" above the finished floor. Service clearance shall be provided in accordance with the National Electric Code and under no circumstances less than the following:

Voltage to Ground	**Minimum Clearance Distance**
110V or 120V	3'-0"
208V, 220V, 240V or 277V	3'-6"
460V or 480V	4'-0"
Greater than 480V	5'-0"

12. Adjustable frequency drives shall be accessible.
13. Provide housekeeping pad for all floor mounted adjustable frequency drives.
14. After installation, phase rotation of each adjustable frequency drive shall be verified to match between bypass operation mode and normal operation modes.

END OF SECTION

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SECTION 23 05 18 - CONTROL WIRING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

B. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Building Control System Wiring - Section 23 09 00.

B. Water Treatment Equipment Interlock Wiring.

C. Fire Protection Systems Wiring.

D. Plumbing Systems Wiring.

E. Control Circuit for Adjustable Frequency Drive Alternator.

F. Interior & Exterior Lighting Control Wiring, including relays and contactors.

1.3 DEFINITIONS

A. Control Wiring: All wiring, high or low voltage other than power wiring, required for the proper operation of the mechanical systems.

B. Power Wiring: All line voltage wiring to the mechanical equipment. Line voltage which also serves as a control circuit, such as a line voltage thermostat, or involves interlocking with a damper, shall be considered control wiring.

1.4 QUALITY ASSURANCE

A. All work will be in accordance with the requirements of the National Electrical Code - Latest Edition.

1.5 SUBMITTALS

A. Submittals are not required.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All material used in the completion of the wiring under this section will comply with the requirements of Division 26 Electrical and Section 23 09 00 – Instrumentation and Controls for HVAC.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Cooperate completely with the contractor for Division 26.

B. Provide all conduit, wire and accessories necessary to complete the control wiring as specified under WORK INCLUDED.

C. Because of variations in requirements from manufacturer to manufacturer, all details may not be included in the Contract Documents. This sub-contractor must obtain approved coordinated wiring diagrams before proceeding with the control wiring.

D. All control wiring shall be properly installed in an approved raceway system or when allowed, run exposed in concealed spaces. All control wiring run in exposed areas shall be in an approved raceway unless otherwise noted.

E. Control wire run exposed shall be neatly bundled and routed parallel and/or perpendicular to building structure or equipment casing. Routing of wire shall be so that it does not interfere, chafe, or obstruct service or maintenance of the equipment served.

F. Exposed control wire shall be properly secured and/or supported within equipment encloses. Cable shall be secured on no greater than 18 inches centers.

G. All openings made for the passing of control wire shall be properly bushed to prevent chafing. Hole size shall be suitable for the quantity of wires or tubing passing through while allowing for ease of pulling and future expansion. Oversized holes beyond these requirements are not allowed.

H. Holes made within air handling equipment which may allow the transfer or bypassing of air shall be properly sealed after wire is pulled. Expanding foam sealant and proper backing material will be acceptable. Seal shall be suitable for maximum unit operating pressures.

I. Attachments of control devices, raceway and cable supports shall be made with proper attachments. Self-drilling screws which result in exposed end will not be acceptable. Bolts and nuts shall be used with bolt head exposed to view. All fasteners located where exposed to weather or moisture shall be stainless steel or cadmium plated.

J. Any opening, holes or cuts in equipment enclosures or building structure not used shall be neatly sealed. On equipment, the seal or patch shall be of similar material sealed and painted to match.

K. The control contractor shall clean all unused or scrap material from the equipment enclosure.

L. All control wire shall be identified by proper cable identification methods. Verify how cables shall be labeled with the Owner's Representative prior to the start of work. All termination shall be labeled and labels clearly visible.

M. All control devices, cabinets, equipment and raceways shall be labeled. Verify how the hardware shall be labeled with the Owner's Representative prior to the start of work.

N. Splices in control wire are not allowed unless the length of run is too great to allow for a continuous run. When splices become necessary, they shall be solder connected with heat shrink tubing. When raceway is used, all splices shall be in junction boxes.

O. Control devices (i.e., flow switches), connected to cold equipment where the possibility of condensation may occur shall be vapor-proof type. The connecting conduit shall be properly sealed with spray type foam after the wires are pulled through. If this is not possible, a weatherproof junction box shall be close mounted to the device to allow for proper moisture sealing. Conduit connections shall be sealed with a silicon type caulk/sealant.

P. All control devices or wiring located exposed to weather or moisture shall be in an approved raceway system. This system shall be properly supported and sealed to prohibit moisture convection or transfer. Provide flexible conduit similar to seal tight for connection to all equipment. EMT and set screw fittings are not acceptable. All exterior raceways shall be IMC (Intermediate Metallic Conduit) or better with threaded fittings.

Q. Where a disconnect switch is mounted between an adjustable frequency drive and the motor, the disconnect must have a late make, early break auxiliary contact. This contact shall be wired into the AFD control circuit so that the control circuit is disconnected before the power circuit it broken.

R. BCS Contractor to fully review the electrical drawings for interlock wiring required for exterior and interior lighting control. BCS contractor to coordinate with the electrical contractor all relays, contactors, programming, and wiring required.

S. BCS Contractor shall provide all conduit, wire, and accessories necessary to complete the interior lighting control interlock if not provided by the electrical contractor.

END OF SECTION

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SECTION 23 05 19 - METERS, GAGES AND ACCESSORIES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

B. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Flow Measuring Meter - Venturi Type.

B. Strainers.

C. Thermometers and Accessories.

D. Pressure Gauges and Accessories.

E. Pressure and Temperature Test Ports.

F. Pressure and Temperature Test Kit.

G. Pump Suction Diffuser.

H. Differential Pressure Type Flow Switch.

I. Install Miscellaneous Control Devices.

1.3 SUBMITTALS

A. Submit schedule of all products used. Include make, model and size. When multiple products will be used, generic size and flow range will be acceptable.

B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

C. Submit in accordance with Division 1 requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Flow Measuring Stations - Venturi Type:

1. Aeroquip Corporation (BARCO)
2. Flow Design, Inc.
3. Gerand, Inc.
4. Victaulic Co. of America
5. Engineer-approved Equal

B. Strainers:

1. Crane
2. ITT Grinnell
3. O.C. Keckley
4. Mueller Steam Specialty Co. (MUESSCO).
5. RP&C Division, Conbraco Industries, Inc.
6. Victaulic Co. of America
7. Wheatley Gaso, Inc.
8. Engineer-approved Equal

C. Thermometers and Accessories:
   1. Duro Instrument Corp.
   2. Taylor
   3. H.O. Trerice
   4. Weiss
   5. Weksler
   6. Winter's Thermogauges
   7. Engineer-approved Equal

D. Pressure Gauges and Accessories:
   1. Ashcroft
   2. Duro Instrument Corp.
   3. H.O. Trerice
   4. Weiss
   5. Weksler
   6. Winter's Thermogauges
   7. Engineer-approved Equal

E. Pressure and Temperature Test Ports:
   1. Peterson Equipment Co., Inc.
   2. Sisco P/T Plugs
   3. Engineer-approved Equal

F. Pressure and Temperature Test Kit:
   1. Peterson Equipment Co., Inc.
   2. Sisco P/T Plugs
   3. Engineer-approved Equal

G. Pump Suction Diffuser:
   1. Armstrong Pump Co.
   2. Bell and Gossett
   3. Flow Conditioning Corp.
   4. Mueller Steam Specialty Co (MUESSCO).
   5. Taco, Inc.
   6. Victaulic Co. of America
   7. Wheatley Gaso, Inc.
   8. Engineer-approved Equal

H. Differential Pressure Type Flow Switch:
   1. Allen Bradley 836-T-D400 Series
   2. Engineer-approved Equal.

2.2 FABRICATION

A. Strainers:

1. "Y" Pattern:

a. HVAC Water Service:

i. Size 1/4 inch thru 2 inch: Cast iron body, threaded connection, threaded blow-off cover, removable stainless-steel screen .045-inch perforations, rated at 450 PSIG. Temperature and pressure test port extended to clear required insulation on each side of strainer. Based on Mueller Steam Specialty Co. (MUESSCO) #11M.

ii. Size 2-1/2 inch and up: Cast iron body, flanged connection, flanged blow-off cover. Blow-off cover tapped for blow-off valve, removable stainless-steel screen .045-inch perforations, rated at 125 PSIGG. If grooved mechanical system is in use a "T" type grooved end, ductile iron body, available with blow off, 304 SS removable screen, choice of mesh size. Temperature and pressure test port extended to clear required insulation on each side of strainer. Based on Mueller Steam Specialty Co. (MUESSCO) #751.

2. Basket Strainer:

a. HVAC Water Service:

i. Size 4 inch and up: Cast iron body, flanged connection, flanged cover, cover tapped for air vent, body tapped for drain valve, removable stainless-steel basket .125 inch perforations rated at 150 PSIG. Based on Mueller Steam Specialty Co. (MUESSCO) #165.

B. Thermometers and Accessories:

1. Industrial Reading Non-Mercury Type:

a. Construction: Adjust angle, 9 inch scale with lagging extension brass well, of the blue dye (only) fill type and guaranteed accurate to + one scale division with appropriate graduation. Thermometer shall have glass front to exclude dirt and dust. Thermometers containing mercury are not acceptable. Thermometers installed outdoors shall be specifically designed and weatherproofed for this application.

b. Stem Length:

i. 6 inch pipe and smaller 3-1/2 inch

ii. 8 inch to 12 inch pipe 6 inch

iii. For storage tanks 9 inch

c. Ranges:

i. Chilled and condenser water: 0 to 120-degrees F or 0 to 100-degrees F as available.

ii. Domestic & heating hot water: 30 to 240-degrees F

d. Based on Weksler Type EG5H-9

2. Bi-Metal Dial Type:

a. Construction: 5 inch dial, adjust-angle, with lagging brass extension well. Stainless steel case bezel, fittings and stem. Head assembly sealed against dust, fumes and moisture with glass window. Accuracy of ± 1% of thermometer range and also be externally adjustable.

b. Stem Length:

i. 6 inch pipe and under 2-1/2 inch

ii. 8 inch to 12 inch pipe 4-1/2 inch

iii. For storage tanks 7-1/2 inch

c. Range:

i. Chilled and condenser water 0 to 150-degrees F

ii. Domestic & heating hot water 20 to 240-degrees F

d. Based on Weksler Type AF.

3. Thermometer Well: Construction - Brass or ductile iron body, with lagging extension, length to accommodate thermometer stem length. Based on Weksler.

C. Pressure Gauges and Accessories:

1. Pressure Gauges:

a. Construction: 4-1/2 inch dial, high impact polypropylene case, 1/4 inch bottom connection, 1/2% accuracy in accordance with ANSI B40.1 - 1974 Grade A. Stainless steel rotary with stainless steel pinion gear; stainless steel sector gear; stainless steel link. Stainless steel bourdon tube, 316 stainless steel socket and slotted adjustable pointer.

b. Case of black high impact polypropylene suitable for surface or direct mounting and with bottom connection. For outdoor locations, provide glycerin filled gauges.

c. Range: Ranges shall be selected to indicate pressure reading in midpoint of scale selected.

d. For condenser water, ice water and other open system pumps, provide a compound gauge with dial calibrated to read in. hg. vac. as well as pressure.

e. Based on Weksler Model AA44-2 and AY44-2.

2. Ball Valve Shut-Off: See Ball Valves Section 23 05 23.

3. Manifold Valves (Trumpet Valve) (Water): 2, 3 or 4 port - Brass body, spring return, push button brass valves, 1/4 inch compression connections. Gauges tap at top, calibrated gauge test port with gauge cock. 125 PSIG rated, 20-degrees F to 220-degrees F range. Based on Flow Conditioning Corporation Hydronic Indicator System.

4. Piston type snubber: Brass body, threaded connections, suitable for mounting horizontal or vertical (required at pump inlet and discharge). Based on Weksler Type RS-1.

5. Filter type snubber: Brass body, threaded connection, micro metallic stainless-steel filter. (For all gauges except pump service). Based on Weksler Type BW42.

D. Pressure and Temperature Test Ports:

1. Brass or stainless-steel body with threaded cap and gasket, length to extend past insulation.

2. Two self-closing valves with intermediate pocket for added pressure protection. Sized for standard 1/8 inch probe.

3. Range: 20-degrees F to 230-degrees F.

4. Rating: 250 PSIG water.

5. Based on Peterson Equipment Co., Inc. "Pete's Plug" Model 110 or 110XL.

E. Pressure and Temperature Test Kit:

1. Pressure-temperature test kits consisting of 0-100 PSIG pressure gauge with adapter, 25-125-degrees F testing thermometer, 0-220-degrees F testing thermometer, gauge adopted and protective carrying cast and master air vent assembly.
2. Provide 2 test kits to the Standards & Design Office at the closeout of the project.
3. Based on Peterson Equipment Co., Inc., Series 1500 Test Kit.

F. Pump Suction Diffuser:

1. End Suction Diffuser:
   a. Construction: Cast iron angle type body with inlet vanes and combination diffuser-strainer-orifice cylinder with 3/16 inch diameter openings for pump protection flanged connection. A permanent magnet shall be located within the flow stream and shall be removable for cleaning. The orifice cylinder shall be equipped with a disposable fine mesh strainer, which shall be removed after system start-up. Orifice cylinder shall be designed to withstand pressure differential equal to pump shutoff head and shall have a free area equal to five times cross section area of pump suction opening. Vane length shall be no less than 2-1/2 times the pump connection diameter. Unit shall be provided with adjustable support foot to carry weight of suction piping. Body tapped for pressure gauge and strainer blow-down. Based on Bell and Gossett.
   b. Size: Inlet system pipe. Outlet pump suction size. When an inlet size pipe size by pump suction size diffuser is not available, provide an inlet size by size nearest to pump suction and a flanged eccentric reducer from pump suction diffuser outlet size to pump suction size.
2. Double Suction Diffuser:
   a. Construction: Angle type cast iron body with 125# ANSI flanged inlet and outlet connections, exit vane, cast bronze venturi rings and double inlet stainless steel orifice cylinder assembly arranged for service removal from either end of cylinder. A threaded blow-down connection shall be located to remove accumulated debris. Inlet and outlet connections shall be equipped with 1/4 inch gauge tapping's. Diffusers shall be equipped with start-up strainer which shall be removed after initial operation. Orifice cylinders shall be selected to withstand a pressure differential equal to pump shut-off head. Clean unit pressure drop at 10 fps pump suction velocity shall not exceed 2 PSIG. Based on Flow Conditioning Corp.
   b. Size: Inlet system pipe. Outlet pump suction size. When an inlet size pipe size by pump suction size diffuser is not available, provide an inlet size by size nearest to pump suction and a flanged eccentric reducer from pump suction diffuser outlet size to pump suction size.
3. Grooved End Suction Diffuser:
   a. Construction: Body, coupling, end cap shall be of ductile iron conforming to ASTM A-536, with enamel coating. Diffuser shall be 304 SS with 3/16-inch diameter holes. Start up bronze 16 mesh screen shall be removed after system start up. Unit shall have two 1/4 inch plugged bosses for pressure taps. A 3/4-inch plug shall be provided on the base for draining. Unit shall be provided with 1-1/4 inch Schedule. 40 pipe support. Vane length shall be no less than 2-1/2 times the pump connection diameter. Based on Victaulic
   b. Size: Inlet system pipe. Outlet pump suction size. When an inlet size pipe size by pump suction size diffuser is not available, provide an inlet size by size nearest to pump suction and a flanged eccentric reducer from pump suction diffuser outlet size to pump suction size.

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G. Differential Pressure Type Flow Switch:
   1. Switch to have bellows suitable for 175 PSIG.
   2. Suitable for use with water.
   3. Adjustable pressure difference (Hi-Low).
   4. Adjustable differential (Cut out to cut in).
   5. Pulsation snubber.
   6. NEMA-12 enclosure.

PART 3 - EXECUTION

3.1 GENERAL

A. Install in accordance with manufacturers written installation instructions.

3.2 INSTALLATION

A. Strainers:
   1. "Y" Patterns:
      a. Strainers preceding automatic steam control valves shall be installed with the strainer branch in the horizontal position to eliminate the formation of a water pocket in the strainer branch.
      b. All non-steam “Y” pattern strainers shall be installed with the strainer branch in the downward vertical position.
      c. For all “Y” pattern strainers, provide blow-off valve assembly consisting of ball-type drain valve with hose end cap and pipe nipple.
      d. Provide pressure-temperature test plugs before and after each strainer.
   2. Basket Strainer:
      a. Install basket strainer on housekeeping pad with rubber mat between pad and strainer (See Section 23 05 48 or specs on rubber mat).
      b. Provide manual air vent in top of cover.
      c. Provide ball valve nipple and plug for drain valve assembly. Valve to be 3/4 inch unless otherwise noted.
      d. Provide pressure-temperature test plugs before and after each strainer.

B. Thermometers and Accessories:
   1. Install and adjust thermometers for optimum visibility.
   2. Provide thermometers indicated on schematic flow diagram or schematic equipment details.
   3. Install thermometers in compatible thermometer wells.

C. Pressure Gauges and Accessories:
   1. Install and adjust gauge for optimum visibility.
   2. Provide ball valve shut-off for all hydronic gauges.
   3. Provide a manifold valve to facilitate the use of a single gauge to monitor pressure differential from various points of a single piece of equipment (i.e., pump; strainer suction; pump suction; pump discharge, etc.). Mount valve for optimum visibility and access.
   4. In lieu of the trumpet valves the contractor may assemble individual components using ball valves as the isolation valve provided the same functions of the trumpet valve are duplicated.

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5. Provide piston type snubbers for pump service.
6. Provide filter type snubbers for all other fluid services.
7. Open shut-off valve only enough to obtain accurate reading. Valve to gauge to be closed at all other times.

D. Pressure and Temperature Test Ports:
1. Install in upright or vertical position as indicated on schematic flow diagram or schematic equipment details.
2. Install in tee or welded outlet.

E. Pressure and Temperature Test Kit: Turn complete kits in good working condition over to Owner, when the Owner takes over the building.

F. Pump Suction Diffuser:
1. Provide suction diffuser for each end suction pump unless design provides for 5 diameters of straight pipe upstream of suction inlet.
2. Support weight of suction diffuser independent of pump.
3. Provide blow-down tap sized nipples, 90-degrees F, ball valve and plug for blow-down valve assembly.
4. After system has been thoroughly cleaned and flushed and prior to turning over to Owner, remove the fine mesh strainer. Turn the strainer over to Owner.

G. Differential Pressure Type Flow Switch:
1. Install in accordance with manufacturer's instructions. Located tape between shut-off valve and vessel.
2. Settings of pressure differential pressure as required pressure difference and to provide proper protector flow or no flow per catalog data.
3. Wire time delay relay to permit start-up with no flow condition. Delay can be omitted where manufacturer has time delay integral with control circuit.
4. Install a pressure and temperature test port within three feet downstream of each differential pressure switch connection to piping system for use in verifying calibration of BAS readouts.

H. Install miscellaneous control devices such as thermometer wells, tees for flow measuring stations, connections for differential pressure sensors, etc.

END OF SECTION

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SECTION 23 05 23 - VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

B. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Automatic Flow Control Valves.

B. Ball valves.

C. Butterfly valves.

D. Check valves.

E. Combination Automatic Flow Control and Shutoff Valves.

F. Combination Strainer and Shutoff Valves.

G. Valves for Mechanical Joint Systems.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this Section to the extent referenced. The publications are referenced to in the text by the basic designation only.

1. American National Standards Institute (ANSI).
2. American Society for Testing and Materials (ASTM).

1.4 SUBMITTALS

A. Submit schedule and cut-sheets indicating service, make and model number, pressure class, end type and usage (i.e., balance, shut-off).

B. Product data shall be included in the operation for maintenance instruction manuals along with installation, operation and maintenance instructions.

C. Submit in accordance with Division 1 requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Automatic Flow Control Valves:

1. Flow Design, Inc.
2. Nexus Controls
3. Griswold Controls
4. Engineer-approved Equal

B. Ball Valves:

1. Apollo
2. Crane Company
3. Hammond Valve
4. Milwaukee Valve.
5. Nibco, Inc.
6. Watts
7. Engineer-approved Equal

C. Butterfly Valves:
   1. API International, Inc.
   2. Bray International, Inc.
   3. Crane Company
   4. Demco
   5. DeZurik
   6. Grinnell
   7. Hammond Valve
   8. Keystone Valve Co., U.S.A.
   9. Milwaukee Valve
   10. Mueller Steam Specialty, Co. (Muessco)
   11. Nibco, Inc.
   12. Engineer-approved Equal

D. Check Valves:
   1. API International, Inc.
   2. Hammond Valve
   3. Milwaukee Valve
   4. Mueller Steam Specialty, Co. (Muessco)
   5. Nibco, Inc.
   6. Walworth
   7. Engineer-approved Equal

E. Combination Automatic Flow Control and Shutoff Valves:
   1. Flow Design, Inc.
   2. Nexus Controls
   3. Griswold Controls
   4. Engineer-approved Equal

F. Combination Strainer and Shutoff Valves:
   1. Flow Design, Inc.
   2. Nexus Controls
   3. Griswold Controls
   4. Engineer-approved Equal

G. Valves for Mechanical Joint Systems: Where a mechanical joint system is proposed, valves shall be furnished by the system supplier where appropriate and shall be equal to those specified.

2.2 FABRICATION

A. Automatic Flow Control Valves:
   1. HVAC or Potable Water Service:
      a. Size 1/2 inch thru 2-1/2 inches: Brass wye body design, thread or sweat connection, ground joint union, dual temperature and pressure test ports extended to clear required insulation, range 20-degrees F to 230-degrees F rated at 400 psi water. Stainless steel or nickel-plated piston brass orifice and spring, replaceable without removing from installation, factory set to control the flow rate within 5% of the tagged

rating over an operating pressure differential of at least 10 times the minimum required for full flow condition. GPM and direction of flow shall be clearly marked on flow control valves. Wide open pressure drop shall not exceed 10 feet. Valves shall be calibrated for the fluid being pumped.

b. Size 2-1/2 inches thru 12 inches: Ductile iron body, wafer style connection, dual temperature and pressure test ports, range 20-degrees F to 230-degrees F rated at 150 psi. Stainless steel or nickel-plated piston brass orifice and spring, factory set to control the flow rate within 5% of the tagged rating over an operating pressure differential of at least 10 times the minimum required for full flow condition. GPM and direction of flow shall be clearly marked on flow control valves. Wide open pressure drop shall not exceed 10 feet. Valves shall be calibrated for the fluid being pumped.

B. Ball Valves:

1. HVAC water service:

a. Size 1/4 inch thru 2 inches. Two-piece, adapter loaded, full port type with brass body, threaded or sweat connection, stainless steel stem, stainless steel ball, Teflon or silicone bronze seat, steel lever handle, indicator stop, 150 lb. 600 WOG.

b. Valves installed in insulated piping to have extended handles to clear insulation. Stem extension shall be made of a non-thermal conducting material with a sleeve to form an insulated vapor seal after the valve is insulated.

C. Butterfly Valves:

1. HVAC water service – Above Ground Use:

a. Size 2-1/2 inches thru 4 inches: 416 stainless steel stem, lug wafer body drilled and tapped for isolation and removal of downstream piping, cast iron or ductile iron body, long neck body extended to allow for a minimum of 2 inch insulation, aluminum bronze or stainless-steel disc, bubble tight EPDM seat, infinite position, memory stop handle. Class 150, 20-degrees F to 210-degrees F range. Based on Nibco LD-2000-3.

b. Size 6 inches and up: As described above with totally enclosed weatherproof gear actuator with indicator and memory stop. Based on Nibco LD-2000-5 for sizes 6 inches to 12 inches.

c. Size 2-1/2 inches - 12 inches grooved end: Ductile iron body to ASTM A-536 with PPS coating and ductile iron disc to ASTM A-536. 2-1/2 inches - 4 inches to have infinitely variable memory stop handle. Valves 6" and above to have gear operator. Valve has bubble tight shut off up to 300 psi and 230o. Valve will have a bracket allowing up to 2 inches insulation.

d. Valves installed in insulated piping to have extended handles to clear insulation.

2. HVAC water service - Below Ground Use:

a. Size 2-1/2 inches and above: 416 stainless steel stem, lug wafer body drilled and tapped for isolation and removal of downstream piping, cast iron or ductile iron body, long neck body extended to allow for a minimum of 2 inches insulation, aluminum bronze or stainless-steel disc, bubble tight EPDM seat. Totally enclosed weatherproof, permanently lubricated gear actuator with operating not complying with ASWWA C504.

D. Check Valves:

1. HVAC water service.

a. Horizontal swing check valve:

i. Size 1/4 inches thru 2 inches. Bronze body threaded or sweat connection, "Y" pattern, bronze seat, renewable teflon or bronze, swing disc, 125 lb. SWP-200 lb. WOG (non-shock).

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ii. Size 2-1/2 inches and up. Iron body flanged connection, bolted cover, bronze seat, renewable bronze swing disc, brass hinge pin, 125 lb. SWP-200 lb. WOG (non-shock).

b. Vertical lift check valve.

i. Size 3/8 inches thru 2 inches. Bronze body, threaded or sweat connection, renewable teflon disc and seat, copper or stainless-steel spring loaded, stainless steel or silicone bronze stem, Class 125.

ii. Size 2-1/2 inches thru 10 inches. Iron wafer type body, taped lug connection, renewable bronze disc and seat, stainless steel spring loaded, bronze guide pin, Class 125.

iii. Size 12 inches and up. Iron globe body, flanged connection, renewable bronze disc and seat, stainless steel spring loaded, bronze guide pin, Class 125. Size 2-1/2 inches thru 12 inches (grooved end): Ductile iron body, grooved end connection 316 SS disc, EPDM seat, with tilted disc for 2-1/2 - 3 inches, and dual disc 4 inches thru 12 inches. Valve may be installed horizontally or vertically for temperature ratings up to 230-degrees.

E. Combination Automatic Flow Control and Shutoff Valves:

1. HVAC or Potable Water Service:

a. Size 1/2 inches thru 2: Brass wye body thread or sweat connection, union, two-temperature and pressure test port extended to clear require insulation, brass or bronze ball valve with stainless steel ball and stem, non-thermal conductive material type actuator extended to clear required insulation for chilled water applications, steel lever type for heating applications. Range 20-degrees F to 230-degrees F rating 400 psi water. Stainless steel or nickel-plated piston brass orifice and spring, replaceable without removing from installation, factory set to control the flow rate within 5% of the tagged rating over an operating pressure differential of at least 10 times the minimum required for full flow condition. GPM and direction of flow shall be clearly marked on flow control valves. Wide open pressure drop shall not exceed 10 ft. Valves shall be calibrated for the fluid being pumped.

F. Combination Strainer and Shutoff Valves:

1. HVAC or Potable Water Service:

a. Size 1/2 inches thru 2 inches: Brass body, thread or sweat connection, ground joint union, temperature and pressure test port extended to clear required insulation (on each side of the valve), ball valve with non-thermal conductive material type actuator extended to clear required insulation for chilled water applications, lever type for heating applications. Removable stainless strainer, 40 mesh for .25 gpm and up, 20 mesh for 1.25 gpm and up. Unit side drain and strainer blow-down valve. Rated at 400 PSIG.

G. Valves for Mechanical Joint Systems: Valves shall be constructed as described above for the type used.

PART 3 - EXECUTION

3.1 GENERAL

A. Provide shut-off valves on the inlet and outlet of each piece of equipment at the take-off each major branch from a header and at the base of each pipe riser in order to facilitate service.

B. Provide drain valves at the base of each pipe riser and at each piece of equipment to facilitate service.

C. Provide locking device on handle of the expansion tank isolation valve to prevent accidental closing.

D. All valves and accessories located in the thermal storage loop shall be rated for 50% ethylene glycol and down to 20-degrees F.

3.2 INSTALLATION

A. Flow Control Valves:
   1. Install with taps in upright or vertical position.
   2. Tag valve for:
      a. Type of service.
      b. Flow in GPM.
   3. The contractor shall assume the responsibility to obtain the necessary gauges and thermometers to properly take the differential pressure and temperature readings from the flow control valves.
   4. All flows shall be verified.

B. Ball Valves:
   1. Install valves with adequate access to lever actuator.
   2. Provide adequate space for actuator handle in the open and closed position and for packing replacement.
   3. Provide infinite position handle with memory stop on the outlet of all heat exchangers for balancing purposes.

C. Butterfly Valves:
   1. Install valve between face of 125# or 150 standard ANSI flanges or standard grooved couplings.
   2. Assure unrestricted valve movement after installation. Valves should be installed with stem of valve parallel to floor.

D. Check Valves:
   1. Horizontal swing check valves: Install valve with swing disc in the pendent position, cover in upright position.
   2. Vertical lift check valve:
      a. Install valve in vertical position, upward flow.
      b. Flanged valves will be installed between 125# or 150 ANSI flanges or other flanged valves.
      c. A spool piece a minimum of 6 inches face to face will be used to separate a vertical lift check valve and a butterfly valve.
      d. Inspect the face of the flange and valve for casting/matching burrs. If burrs exist move by draw filling prior to gasket placement.
      e. Grooved end check valves shall be installed with standard grooved couplings.

E. Combination Flow Control and Shutoff Valves:
   1. Install with taps in upright position in a manner that will allow all the taps to be used as an air vent.
   2. Tag valve for:
      a. Type of service.
      b. Flow in GPM.
   3. Obtain the necessary gauges and thermometers to properly take the differential pressure and temperature readings from the flow control valve.
   4. All flows shall be verified.

F. Combination Strainer and Shutoff Valves:

1. Install with taps in upright position in a manner that will allow the tap to be used as an air vent.
2. All strainers shall be blown down prior to turning system over to Owner.

G. Valves for Mechanical Joint Systems: Valves shall be installed as described above for the type used.

END OF SECTION

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SECTION 23 05 29 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

B. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Inserts, Shells and Upper Attachments.

B. Pipe Hangers, Rods, Supports and Accessories.

C. Pipe Sleeves.

D. Pipe Seals.

E. Duct Hangers and Supports.

F. Duct Sleeves.

G. Fabricated Steel Support.

1.3 QUALITY ASSURANCE

A. Design of pipe supporting elements shall be in accordance with ANSI B31.1.

B. Fabrication and installation of pipe hangers and supports shall be in accordance with the following Manufacturers Standardization Society (MSS) Standards.

1. SP-58 Pipe Hangers and Supports: Materials, Design and Manufacture.
2. SP-69 Pipe Hangers and Supports: Selection and Application.
3. SP-89 Pipe Hangers and Supports: Fabrication and Installation Practices.

C. Steel angles, channels and plate shall be in accordance with ASTM A36, red primed or hot dipped galvanized for interior applications, and hot galvanized for exterior applications.

D. Bolts, including nuts and washers, used for fabricating steel members shall be in accordance with ASTM A325 and shall be stainless steel or plated for corrosion protection. Plain steel components are unacceptable.

E. Welding of steel members shall be in accordance with AWS D1.1.

F. Duct hangers and supports shall be in accordance with SMACNA HVAC Duct Construction Standards – Metal and Flexible as applicable.

G. Steel supports for ducts, pipe anchors, pipe guides, and piping supported from below shall be fabricated in accordance with AISC Specification for the Design, Fabrication and Erection of Structural Steel for buildings. If required, the contractor shall include the cost of the services of a structural engineer to design or review the system.

1.4 APPLICABLE PUBLICATIONS

A. Applicable sections of the publications listed below form a part of this Section. The publications are referenced to in the text by the basic designation only.

1. American Institute of Steel Construction (AISC)
2. American National Standards Institute (ANSI)
3. American Society for Testing and Materials (ASTM)
4. American Welding Society (AWS)
5. The Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS)
6. National Fire Protection Association (NFPA)
7. Sheet Metal and Air Conditioning Contractor's National Association, Inc. (SMACNA).

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1.5 SUBMITTALS

A. Submit schedule indicating type of hanger to be used by system and pipe size. Include rod size for each hanger size.

B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

C. Submit in accordance with Division 1 requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Inserts, Shells and Upper Attachments:

1. Anvil International, Inc.
2. Carpenter Paterson, Inc.
3. Cooper B-Line, Inc.
4. Elcen Metal Products
5. Hilti
6. Michigan Hanger Company
7. PHD Manufacturing, Inc.
8. Unistrut.

B. Pipe Hangers, Rods, Supports and Accessories:

1. Anvil International, Inc.
2. Carpenter Paterson, Inc.
3. Cooper B-Line, Inc.
4. Elcen Metal Products
5. Hilti
6. Michigan Hanger Company
7. PHD Manufacturing, Inc.
8. Unistrut.

C. Pipe Sleeves:

1. Metraflex - Metraseal
2. Thunderline Corporation - Link Seal

D. Pipe Seals:

1. Metraflex - Metraseal
2. Thunderline Corporation - Link Seal

E. Duct Hangers and Supports: Fabricated per Specifications

F. Duct Sleeves: Fabricated per Specifications

G. Fabricated Steel Support: As Detailed on Drawings.

2.2 FABRICATION

A. Inserts, Shells and Upper Attachments:

1. Inserts; MSS Type 18; malleable iron body and nut, galvanized finish, opening in top of insert for reinforcing rod, lateral adjustable. Rated for 1,140 lbs. Based on Anvil Fig. 282.
2. Shells: Steel shell and expander plug, snap off end fastener. Based on Phillips Concrete Fasteners Red Head.

3. Upper Attachments:
    a. Top beam clamps; MSS Type 19: Malleable iron galvanized finish clamp, hardened steel cup point set screw and locknut. Rating is contingent on rod and bolt size. Based on Anvil Fig. 94.
    b. Bottom Beam Clamp; MSS Type 23: Malleable iron galvanized finish clamp, hardened steel cup point set screw and locknut, and retaining clip. Rating is contingent on rod and bolt size. Based on Anvil Fig. 86 Clamp and Fig. 89 Retaining Clip (or Fig. 87).
    c. Welded Beam Attachment; MSS Type 22: Carbon steel suitable for eye rod or rod and locknut, rating is contingent on rod and bolt size. Based on Anvil Fig. 66.
    d. Center Beam Clamp; MSS Type 21: Malleable iron jaw and square head bolt and nut with galvanized finish. Rating is contingent on rod and bolt size. Based on Anvil Fig. 134.
    e. Center Beam clamp; MSS Type 29: Forged steel, weldless eye nut, tie rod to secure clamp to beam all with galvanized finish, rating is contingent on rod and bolt size. Based on Anvil Fig. 292 or 292L.

B. Pipe Hangers, Rods, Supports and Accessories:
1. Pipe Hangers:
    a. Clevis Hanger; MSS Type 1: Carbon steel, galvanized for interior and exterior use, sized to accommodate required insulation. Rating is contingent on rod and bolt size. Based on Anvil Fig. 260 or 300.
    b. Pipe Rings; MSS Type 10: Carbon steel, galvanized for black steel and insulated pipe copper or copper plated or rubber coated for copper pipe. Threaded swivel sized to accommodate required insulation. Rating is contingent on rod and bolt size. Based on Anvil Fig. 69 or Fig. 97C for copper pipe.
    c. Adjustable Roller Hanger; MSS Type 43: Cast iron roll, carbon steel yoke rod roll and hex nut with galvanized finish. Sized to accommodate insulation. Rating is contingent on rod and bolt size. Based on Anvil Fig. 181.
2. Rods:
    a. Size 3/8 inch and up: All thread steel rod electro galvanized. Sizing for pipe or equipment support as follows:

        Copper Tube, Plastic, Steel, Cast Iron or Fiberglass Reinforced Glass Max Equip.

Pipe Size	Pipe Size	Rod Diameter	Maximum Equip Load
1/4" to 2”	1/4" to 2”	3/8"	730 lbs.
2-1/2" to 5”	2-1/2” to 3”	1/2"	1350 lbs.
6”	4” to 5”	5/8"	2160 lbs.
8” to 12”	6”	3/4"	3230 lbs.
14”	8” to 12”	7/8”	4480 lbs.
16”	14” to 16”	1”	5900 lbs.
18” to 20”	18” to 20”	1-1/4”	9500 lbs.
22” to 42”	22” to 42”	1-1/2”	13,800 lbs.

    b. Rods may be reduced one size for double rod hangers with 3/8 inch minimum diameter, or when other paragraphs require a minimum of 2 hangers per section provided the minimum diameter of 3/8 inch in maintained.
    c. Based on Anvil Fig. 146.
3. Supports:
    a. Pipe Saddle; MSS Type 38: Cast iron saddle, black steel lock nut nipple, cast iron reducer all with galvanized finish. Suitable for standard field cut and threaded

galvanized steel pipe. Cast iron floor flange. Based on Anvil Fig. 264 Saddle, Fig. 63 Floor Flange.

b. Pipe Saddle Cold Piping: MSS Type 40. Single bonded unit consisting of a galvanized metal shield and a molded section of rigid polyurethane foam insulation. Rigid urethane foam shall have a density of 4 pounds per cubic foot, a thermal conductivity of 0.13 Btu.in/sq.ft./hr F at 75-degrees F mean temperature. Insulation thickness to be equal to thickness specified for pipe being supported.

c. Adjustable Pipe Roll and Base; MSS Type 46: Cast iron base plate steel stand and roll, adjusting screws with galvanized finish. Based on Anvil Fig. 274.

d. Welded Steel Bracket; MSS Type 32: Welded carbon steel rate for 1500 lbs., with galvanized finish. Rating is contingent on rod and bolt size. Based on Anvil Fig. 195.

e. Riser Clamps; MSS Type 8: Carbon steel, galvanized finish for black steel or galvanized pipe, plastic coated for cold steel, copper, glass or brass pipe rated for a minimum of 220 lbs. at 3/4 inch size. Based on Anvil Fig. 261.

4. Accessories:

a. Protective Shields; MSS Type 40: Carbon steel, galvanized minimum of 12 inches length sized for required insulation. Based on Anvil Fig. 167.

b. Protective Saddles; MSS Type 39: Carbon steel plate, minimum of 12 inches length, sized for required insulation. Based on Anvil Fig. 160 thru 165.

c. Steel Turnbuckle; MSS Type 13: Forged steel, galvanized finish with locknuts. Rated at a minimum of 730 lbs. at 3/8 inch size. Based on Anvil Fig. 230.

d. Steel Clevis; MSS Type 14: Forged steel, galvanized finish with steel pin and cotter pin. Rated for a minimum of 730 lbs. at 3/8 inch size. Based on Anvil Fig. 299.

e. Weldless Eye Nut; MSS Type 17: Forged steel, galvanized finish. Rated for a minimum of 730 lbs. at 3/8 inch size. Based on Anvil Fig. 290 or 290L.

C. Pipe Sleeves:

1. Wall: Schedule 40 carbon steel pipe sized to accommodate pipe and insulation. If sleeves are field cut coat cut edges with cold galvanizing spray, ZRC or equivalent.

2. Floor or Exterior Walls below Grade: Schedule 40 steel pipe with anchor and water stop hot dip galvanized after fabrication. Sized to accommodate pipe (pipe insulation if required). Sleeve length will be sized to allow a minimum of 1/2 inch extension below floor or exterior side of a wall below grade and 1-1/2 inch extension above floor and 1/2 inch extension on interior side of an exterior wall below grade.

3. Based on Thunderline Corp. Link Seal Wall Sleeve.

D. Pipe Seals: Composition Plastic Pressure Plates, zinc coated bolts, nuts and metal parts, composition rubber sealing element designed for long term stability rated for temperatures of 40-degrees F to +250-degrees F. Based on Thunderline Corp. Link Seal LS Series.

E. Duct Hangers and Supports: Fabrication and application of duct hangers and supports shall be in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, Latest Edition, as applicable.

F. Duct Sleeves: Sleeves shall be provided for ducts penetrating concrete and masonry walls, stud framed fire rated walls, and poured- in-place concrete floors and roofs. Sleeves shall be sized to accommodate duct and insulation.

G. Fabricated Steel Supports:

1. Field or shop fabricated. See details on drawings.

2. If not detailed on drawings the contractor is to provide suitable supports as required.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Where applicable install in accordance with the manufacturers written installation instructions.

B. Where supports are in contact with copper pipe provide copper plated support or wrap pipe with sheet lead.

C. Where supports are in contact with glass, aluminum or brass pipe provide plastic coating on supports, or wrap pipe with sheet plastic.

D. General interior supports, including attachments and pipe supports that are plain steel shall be cleaned of all rust, primed, and painted black within one week of installation. The schedule shall be fully coordinated with the Owner and all programming including by this contractor. At substantial completion all supports shall be free of rust and in a “like new condition”.

E. Hangers and supports, including attachments & pipe support exposed to weather or located in utility tunnels or accessible utility trenches or subject to spillage shall be hot dip galvanized after fabrication. At substantial completion all supports shall be free of rust and in a “like new condition”.

F. Fabricated steel supports exposed to weather (including pipe supports) or located in utility tunnels and accessible utility trenches or subject to spillage shall be hot dipped galvanized after fabrication, primed and painted black within one week of installation. Cut, welded, drilled, or otherwise damaged surfaces of galvanized coating shall be repaired in accordance with Section 23 02 00. At substantial completion all supports shall be free of rust and in a “like new condition”.

3.2 INSTALLATION

A. Inserts, Shells and Upper Attachments:

1. Inserts:
    a. Contractor shall have inserts at site and dimensioned location drawings ready at the beginning of the involved concrete work.
    b. Install inserts by securing to concrete forms and inserting reinforcing rod thru the opening provided in the insert in accordance with shop drawings.
    c. Provide necessary supervision while concrete is being poured to correct any misalignment caused by the concrete.
2. Shells: Size shell length to assure a minimum of 1 inch solid concrete remaining from shell end to concrete face.
3. Upper Attachment:
    a. Select proper attachment for building construction.
    b. For plain steel devices, prime with black paint prior to installation.
    c. Adjust attachment location for proper alignment and no more than 4-degrees offset from a perpendicular alignment.
    d. If proper alignment cannot be achieved from the existing building structure provide a trapeze type support size to handle the design load with a minimum safety factor of 5.

B. Pipe Hanger, Rods, Supports and Accessories:

1. Select proper hanger for piping systems.
2. The location of hangers and supports shall be coordinated with the structural work to ensure that the structural members will support the intended load.
3. Provide hex head nut on rod at top and bottom of clevis hanger yoke, and at each rod connection to intermediate and upper attachment. Rod nuts shall be securely locked in place.

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4. Hanger rods shall be subject to tensile loading only. Where lateral or axial movement is anticipated, use suitable linkage in hanger rod to permit swing.
5. Hangers shall be fabricated to permit adequate adjustment after erection while still supporting the load. Turnbuckles shall be provided where required for vertical adjustment of the piping.
6. For vibration isolation hanger intermediate attachment requirements for isolated equipment refer to Section 23 05 48.
7. Supports for vertical piping shall be located at each floor or at intervals of not more than 15 feet and at intervals of not more than 8 feet from end of risers. Where supports are provided on intermediate floors spaced 15 feet or less between floors, no additional supports are required other than those specified for end of risers.
8. A hanger or support shall be provided adjacent to each piece of equipment to ensure that none of the pipe weight is supported from the equipment.
9. The maximum spacing between pipe supports for straight runs shall be in accordance with the following chart. If any deviation from the table exists within the manufacturers written installation instructions, whichever spacing reflecting the smaller centerline to centerline dimension shall be used. Maximum horizontal pipe hanger and support spacing table:

Material	Size	Maximum Spacing of Supports
Steel Pipe (Schedule 40 & 80)	Up to 1":	7 ft. on center
	1-1/4" and greater	10 ft. on center
Copper Pipe (Types L, K and M)	Up to 1-1/4" size	5 ft. on center
	1-1/2" to 2-1/2":	6 ft. on center
	3" and larger	10 ft. on center
Ductile Iron and Cast Iron	Two hangers per section length	
Polyvinyl Chloride (PVC)	Up to 1-1/2”	3 ft. on center
	2” and larger	4 ft. on center

10. Hanger centerline spacing shall be reduced by 50% in areas of concentrated valves and/or fittings, also no more than a maximum distance of 12 inches from valves, fittings and/or couplings, or 24 inches from a change in direction.
11. Parallel piping may be supported by trapeze hangers consisting of steel angle, channel, or beam suspended by steel rods attached to upper structure. Piping may be supported above, or suspended below, the angle, channel, or beam.
12. Provide protective shields on all cold and dual temperature piping required to be insulated (see specification Section 23 07 00: Insulation for extent of insulation).
13. Provide protective saddles sized to match insulation thickness on all hot piping required to be insulated (see specification Section 23 07 00: Insulation for extent of insulation). Fill void between saddle and pipe with insulation as specified.
14. Provide turnbuckles on all hangers which require leveling or aligning.
15. Provide steel clevis where detailed and/or required.
16. Provide weldless eye nuts on hanger terminations where disassembly or swing may be required. Use in combination with steel clevis.

C. Pipe Sleeves:

1. Secure sleeves to forms for concrete construction. Ensure sleeves are not disengaged or misaligned by concrete placement operations.
2. Provide temporary cap for open end of sleeves to prevent entrance of concrete.

3. Provide temporary internal bracing where required to prevent distortion of sheet metal sleeves by concrete placement operations.
4. Sleeves shall not be installed in structural members, except where indicated or approved.
5. Furnish sleeves to masonry contractor in advance of masonry work. Furnish dimensioned drawings indicating exact location of sleeves.
6. Each sleeve shall extend through its respective wall, floor, or roof, and shall be cut flush with each surface, except as indicated otherwise.
7. Sleeves passing through floors in wet areas, such as areas containing plumbing fixtures or floor drains, shall extend a minimum of 4 inches above the finished floor. Sleeves in wet areas shall be enclosed with 4 inch concrete curb.
8. Unless otherwise indicated, sleeves shall be of a size to provide a minimum of 1/4 inch clearance all around between the pipe and inside of sleeve, or between jacket over insulation and sleeve.
9. Provide membrane clamping devices on sleeves for waterproof floors.
10. Sleeves are not required in existing structures where openings through existing concrete floors, walls, or roof are core drilled.

D. Pipe Seals:
   1. Provide pipe seals for all pipe sleeves used in:
      a. External walls.
      b. Floor slabs on grade.
      c. Upper floors where spillage may occur.

E. Duct Hanger and Supports: Installation of duct hangers and supports shall be in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, Latest Edition, as applicable.

F. Duct Sleeves:
   1. Secure sleeves to forms for concrete construction. Ensure sleeves are not disengaged or misaligned by concrete placement operations.
   2. Provide temporary cap for open end of sleeves to prevent entrance of concrete.
   3. Provide temporary internal bracing where required to prevent distortion of sheet metal sleeves by concrete placement operations.
   4. Sleeves shall not be installed in structural members, except where indicated or approved.
   5. Furnish sleeves to masonry contractor in advance of masonry work. Furnish dimensioned drawings indicating exact location of sleeves.
   6. Each sleeve shall extend through its respective wall, floor, or roof, and shall be cut flush with each surface, except as indicated otherwise.
   7. Sleeves passing through floors in wet areas, such as areas containing plumbing fixtures or floor drains, shall extend a minimum of 4 inches above the finished floor. Sleeves in wet areas shall be enclosed with 4-inch concrete curb.
   8. Unless otherwise indicated, sleeves shall be of a size to provide a minimum of 1/4 inch clearance all around between the duct and inside of sleeve, or between jacket over insulation and sleeve.
   9. Provide membrane clamping devices on sleeves for waterproof floors.
   10. Duct sleeves shall be secured to opening and have a flange turned back to wall to cover any irregularities in the opening provided for the sleeve.

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G. Fabricated Steel Supports: Steel for supports shall be saw cut, with sharp edges ground smooth. After fabrication remove all foreign material, including welding slag and spatter, and leave ready for painting or galvanizing, as applicable.

END OF SECTION

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SECTION 23 05 48 - VIBRATION & SEISMIC CONTROLS FOR HVAC SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

B. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Vibration isolators.

B. Bases.

C. Grooved-Joint Flexible pipe connectors.

D. Braided Flexible pipe connectors.

E. Neoprene Flexible Pipe Connectors.

F. Mass Loaded Vinyl Fabric.

1.3 QUALITY ASSURANCE

A. The vibration isolation materials manufacturer shall be responsible for the proper selection of spring rates to accomplish the specified minimum static deflections for all spring and pad type isolators based on the weight distribution of equipment to be isolated.

B. The vibration isolation materials manufacturer shall be responsible for the structural design of steel beam bases and concrete inertia bases to support mechanical equipment scheduled to receive a supplementary base.

C. Vibration isolation shop drawings shall show isolator locations, and load on each isolator, deflection, compressed spring height, solid spring height, spring diameters and color coding.

D. Where grooved-joint flexible pipe connectors are specified, manufacturer shall design the isolation system and include drawings showing all supports, restraints, etc. as required to ensure performance.

1.4 SUBMITTALS

A. Submit a schedule indicating make, model, type and deflection for each system or weight range.

B. Product data and shop drawings, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

C. Submit in accordance with Division 1 requirements.

D. Submit manufacturer's certification of installation quality.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Vibration Isolators:

1. Amber/Booth Company
2. Mason Industries, Inc.
3. Peabody Noise Control, Inc. - Kinetics.
4. Vibration Mountings and Controls, Inc.

B. Bases:

1. Amber/Booth Company
2. Mason Industries, Inc.
3. Peabody Noise Control, Inc. - Kinetics.

4. Vibration Mountings and Controls, Inc.

C. Grooved-Joint Flexible Pipe Connectors:
1. Central Sprink
2. Grinnell (Gruv-Lok)
3. Tyler Pipe (Gustin-Bacon)
4. Unisource Manufacturing Inc.
5. Victaulic Co. of America

D. Braided Flexible Pipe Connectors:
1. Flexonics
2. Keflex, Inc.
3. Mason Industries, Inc.
4. Metraflex Co.
5. Proco Products, Inc.
6. Southeastern Hose
7. Unisource Manufacturing Inc.
8. Wheatley Gaso, Inc.

E. Neoprene Flexible Pipe Connectors:
1. Flexonics
2. Keflex, Inc.
3. Mason Industries, Inc.
4. Mercer Rubber Company.
5. Metraflex Co.
6. Proco Products, Inc.
7. Unisource Manufacturing Inc.
8. Wheatley Gaso, Inc.

F. Mass-Loaded Vinyl Fabric:
1. Peabody Kinetics, Inc.
2. United Process, Inc.

2.2 MATERIALS

A. Vibration Isolators:
1. Type A: Double Deflection Neoprene Mount: Double deflection neoprene mountings shall have a minimum static deflection of 0.35". All metal surfaces shall be neoprene covered to avoid corrosion and have friction pads both top and bottom, so they need not be bolted to the floor. Bolt holes shall be provided for these areas where bolting is required. On equipment such as small vent sets and close coupled pumps, steel rails shall be used above the mountings to compensate for the overhang. Based on Mason Type ND.
2. Type B: Spring Type Mount: Spring type isolators shall be free standing and laterally stable without any housing and complete with 1/4" neoprene acoustical friction pads between the baseplate and the support. All mountings shall have leveling bolts that must be rigidly bolted to the equipment. Spring diameters shall be no less than 0.8 of the compressed height of the spring at rated load. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Based on Mason Type SLF.

3. Type C: Restrained Spring Type Mount: Spring type isolators shall be laterally stable with housing and complete with 1/4" neoprene acoustical friction pads between the baseplate and the support. All mountings shall have leveling bolts that must be rigidly bolted to the equipment. Spring diameters shall be no less than 0.8 of the compressed height of the spring at rated load. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. A housing shall be used that includes vertical limit stops to prevent spring extension when weight is removed. The installed and operating heights shall be the same. A minimum clearance of 1/2" shall be maintained around restraining bolts and between the housing and the spring so as not to interfere with the spring action. Limit stops shall be out of contact during normal operations. Mountings used out of doors shall be hot dipped galvanized. Based on Mason Model SLR.
4. Type D: Vibration Hangers: Vibration hangers shall contain a steel spring and 0.3" deflection neoprene element in series. The neoprene element shall be molded with a rod isolation bushing that passes through the hanger box. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing thru a 30o arc before contacting the hole and short circuiting the spring. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Based on Mason Model 30N.
5. Type E: Horizontal Thrust Restraints: The horizontal thrust restraint shall consist of a spring element in series with a neoprene pad. The spring diameter shall be no less than 0.8 of the compressed height of the spring at rated load. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. The spring element shall be contained within a steel frame and designed so it can be preset for thrust at the factory and adjusted in the field to allow for a maximum of 1/4" movement at start and stop. The assembly shall be furnished with one rod and angle brackets for attachment to both the equipment and ductwork or the equipment and the structure. Horizontal restraints shall be attached at the centerline of thrust and symmetrically on either side of the unit. Based on Mason Model WB.
6. Type F: Neoprene Isolation Pads: Neoprene isolation pads shall be single rib or crossed, double rib neoprene in-shear pads, in combination with steel shims when required, having minimum static deflections as tabulated. All neoprene pads shall be true neoprene in-shear using alternately higher and lower ribs to provide effective vibration isolation, and shall be molded using 2500 PSI tensile strength, oil resistant, compounds with no color additives. Pads shall be 45 or 65 durometer and designed to permit 60 or 120 psi loading, respectively, at maximum rated deflections. Neoprene in-shear isolation pads shall be provided to meet tabulated minimum operating static deflections without exceeding published maximum static deflections. Use single or, crossed, double rib or laminated composites of both as required. When two pads of ribbed material are laminated, they shall be separated by, and bonded to, a galvanized steel shim plate. Based on Kinetics NPS, NPD, NGS or NGD.

B. Bases:

1. Type 1: Structural Steel Base: All perimeter members shall be beams with a minimum depth equal to 1/10th of the longest dimensions of the base. Beam depth need not exceed 14" provided that the deflection and misalignment is kept within acceptable limits as determined by the manufacturer. Height saving brackets shall be employed in all mounting locations to provide a base clearance of one inch. Based on Mason Model WF.
2. Type 2: Inertia Bases:
   a. The base shall consist of rectangular structural beam or channel concrete forms for floating foundations. Bases for split case pumps shall be large enough to provide support for suction and discharge base ells. The base depth need not exceed 12" unless specifically recommended by the base manufacturer for mass or rigidity. In general, bases shall be a minimum of 1/12th of the longest dimension of the base, but not less than 6". Forms shall include minimum concrete reinforcement consisting of half inch bars or angles welded in place on 6" centers running both ways in a layer

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1-1/2" above the bottom, or additional steel as is required by the structural conditions. Forms shall be furnished with steel members to hold anchor bolt sleeves when the anchor bolts fall in concrete locations. Height saving brackets shall be employed in all mounting locations to maintain a 1" clearance below the base.

b. Inertia bases for pumps shall be large enough to support removable metal insulation cover and suction diffusers where they are used.
c. Based on Mason Type K.

3. Type 3: Curb Mounted Equipment Base: Curb mounted rooftop equipment shall be mounted on vibration isolation bases that fit over the roof curb and under the isolated equipment. The extruded aluminum top member shall overlap the bottom member to provide water runoff independent of the seal. The aluminum members shall house cadmium plated springs having a 1-1/2" minimum deflection with 50% additional travel to solid. Spring diameters shall be no less than 0.8 of the spring heights at rated load. Wind resistance shall be provided by means of resilient snubbers in the corners with a minimum clearance of 1/4" so as not to interfere with the spring action except in high winds. The weather seal shall consist of continuous closed cell sponge materials both above and below the base and a waterproof flexible ductlike EPDM connection joining the outside perimeter of the aluminum members. Foam or other contact seals are unacceptable at the spring cavity closure. Caulking shall be kept to a minimum. Submittals shall include spring deflections, spring diameters, compressed spring height and solid spring height as well as seal and wind resistance details. Based on Mason Type RSC.

C. Flexible Pipe Connectors:

1. Grooved-joint flexible pipe connectors shall consist of a minimum of three flexible pipe couplings. Coupling shall contain a resilient elastomeric gasket conforming to the internal cavity of the coupling housing and providing a pressure responsive seal against the pipe to create a permanent leak tight seal. Assembly shall permit expansion, contraction and deflection and shall dampen noise and vibration.

2. Braided flexible pipe connectors constructed of stainless steel annular corrugated metal surrounded with a woven braid of high tensile stainless steel. Units capable of absorbing pump vibration and noise accept thermal expansion and reduce piping stress due to minor misalignment and pressure variations. Sizes 1/2" through 2" to have carbon steel male pipe thread connections. Sizes 2-1/2" and larger to have carbon steel plate flanges with ASA #150 bolt hole patterns. Sizes through 8" to be suitable for 150 psig working pressure at 200-deg F. Based on Keflex KSSPC.

3. Flexible neoprene connectors shall be used on all equipment as indicated on the drawings or on the equipment schedule. They shall be manufactured of multiple ply’s of nylon tire cord fabric and neoprene both molded and cured in hydraulic rubber presses. No steel wire or rings shall be used as pressure reinforcement. Straight connectors shall have two spheres. Connectors up to and including 1-1/2" diameter may have threaded ends. Connectors 2" and larger shall be manufactured with floating galvanized flanges recessed to lock the connector's raised face neoprene flanges. Hoses shall be installed on the equipment side of the shut-off valves. Connectors shall be rated a minimum of 150 psi at 220oF. Flanged equipment shall be directly connected to neoprene elbows in the size range 2-1/2" through 12" if the piping makes a 90o turn at the equipment. All straight through connections shall be made with twin-spheres properly pre-extended as recommended by the manufacturer to prevent additional elongation under pressure. 12" and larger sizes operating above 100 psi shall employ control cables with end fittings isolated by means of 1/2" thick bridge bearing neoprene washer bushings designed for a maximum of 1000 psi. Based on Mason Flex.

D. Mass-Loaded Vinyl Fabric: Mass loaded vinyl shall achieve the noise transmission loss and meet the physical requirements and flammability rating specified. It shall have a continuous operating temperature range from -40 to +220-deg F and shall be resistant to oils, weak acids, alkalis and weathering. Sound control materials shall be Kinetics Noise Control Type KNM-

100AL mass-loaded vinyl fabric or equal reinforced fabric coated with vinyl and loaded with high-density, completely encapsulated inert fillers. The product shall not contain asbestos. Material shall have a density of 1 lb. per sq.ft., with the following noise transmission loss (dB) frequency (Hz):

125	250	500	1K	2K	4K	STC
15	19	21	28	33	37	27

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. All floor mounted equipment shall be installed on a housekeeping pad, in addition to any isolation or inertia base requirement as specified in Section 15050 - Basic Materials and Methods.

B. Installation of all vibration isolation materials and supplemental equipment bases specified in this section of the specifications shall be accomplished following the manufacturers written instructions.

C. On completion of installation of all isolation materials and before startup of isolated equipment all debris shall be cleared from areas surrounding and from beneath all isolated equipment, leaving equipment free to move on the isolation supports.

D. No rigid connections between equipment and building structure shall be made that degrades the noise and vibration isolation system herein specified. Electrical conduit connections to isolated equipment shall be looped to allow free motion of isolated equipment.

E. Adjust all isolators for uniform support.

F. Readjust all isolators after system start-up to assure constant support.

3.2 INSPECTION

A. The Contractor shall notify the local representative of the vibration isolation materials manufacturer prior to installing any vibration isolation devices. The Contractor shall seek the representative's guidance in any installation procedures he is unfamiliar with.

B. The local representative of the vibration isolation materials manufacturer shall conduct periodic inspections of the installation of materials herein specified and shall report in writing to the Contractor any deviations from good installation practice observed.

C. On completion of installation of all noise and vibration isolation devices herein specified, the local representative of the isolation materials manufacturer shall inspect the complete system and report in writing any installation errors, improperly selected isolation devices, or other fault in the system that could affect the performance of the system.

D. The installing Contractor shall submit a report to the Owner's Representative including the manufacturer's representative's final report indicating all isolation reported as properly installed or requiring correction and include a report by the Contractor on steps taken to properly complete the isolation work.

3.3 VIBRATION ISOLATION SCHEDULE:

A. Ductwork (Main supply and return within and up to 50' of Mechanical Rooms):

1. Base type: None required.
2. Isolator Type: "D"
3. Deflection: .75"

B. Fans, Belted Vent Sets, Roof:

1. Base type: "1"
2. Isolator Type: "C"
3. Deflection: .75"

4. Accessories: Flexible duct connectors (Section 23 33 00).

C. Terminal Boxes (Required on all units that are not provided with factory mounted internal isolation):
   1. Base type: None required.
   2. Isolator Type: "D"
   3. Deflection: .75"

D. Piping (Within and up to 50' outside of Mechanical Rooms):
   1. Base type: None required.
   2. Isolator Type: "A"
   3. Deflection: .75"
   4. Accessories: Flexible pipe connector at exit to room.

E. Packaged Air Handling Units:
   1. Base type: None required.
   2. Isolator Type: Internal spring type provided with AHU.
   3. Deflection: 2 inches
   4. Accessories: Flexible duct connectors (internal fan isolation and Section 23 33 00-flexible duct connectors).

END OF SECTION

SECTION 23 05 58 - INSULATED UNDERGROUND PIPING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

B. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Insulated Underground Piping System shall be Aquatherm. See 23 21 15.

1.3 QUALITY ASSURANCE

A. The Division 23 subcontractor shall provide a complete survey of the route of the piping systems including location of all existing utilities and topography to the supplier of the piping systems.

B. The supplier of the piping systems shall be responsible for the design of the complete engineered pre-insulated piping system, including Carrier pipe, thermal insulation, protective jacketing, fittings, anchors, guides, expansion loops or joints and anchor block design.

C. The supplier of the piping systems shall provide the installing contractor with complete installation drawings and specifications for trench preparation, concrete anchor or thrust block specifications. All units shall be part numbered to correspond to the installation drawings.

D. All components of the piping system shall be suitably inspected after fabrication by X-ray or other means to ensure continuous insulation through each section.

E. Manufacturer shall provide a qualified technician who will be present during critical periods of the installation and testing of the system.

F. After installation and at a minimum 2 days prior to backfilling, the manufacturer’s representative of all piping components provided in this section shall field inspect the piping system and certify in writing to the Owner's representative that the piping system has been assembled and installed within the guidelines of the manufacturer's written installation instructions. This certification shall include but not be limited to trench preparation, anchor, guide and thrust block construction and location, backfill material, expansion loop and joint construction.

1.4 SUBMITTALS

A. Submit shop drawings in accordance with Division 1 requirements.

B. Submit details of joint construction, expansion loop sizing, anchor, guide and thrust block construction.

C. Submit pipe installation inspection report as described in 1.3.F.Piping Systems

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Install in accordance with manufacturer's written installation instructions, including but not limited to unloading and storing, drying of conduit and insulation in the event it becomes wet, trenching with proper attention to required cover height, providing concrete anchor blocks, and installing anchor plates, laying, welding, cold spring procedure, field joint insulation procedure, conduit air test procedure and field joint coating procedure.

B. Prior to insulating and sealing joints and sealing fittings the system should be visually and hydrostatically tested.

C. All underground chilled water systems shall be buried in a trench of not less than 24 inches deeper than the top of the pipe jacket and not less than 18 inches wider than the combined O.D. of all piping systems. Backfill should be tamped compactly in place. No rock shall be used in the

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first foot of the backfill. To meet H-20 highway loading, there must be 24 inches from top of jacket to grade of the compacted fill.

D. Comply with inspection and certification requirements specified in Para. 1.3 - Quality Assurance.

END OF SECTION

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SECTION 23 05 93 - TESTING, ADJUSTING AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Contractor/CM shall use one of TAB vendors listed. Pricing shall be obtained from each vendor, one of whom shall be used by Contractor/CM, to perform TAB work for HVAC systems.

B. Contractor's/CM's bid shall include lowest responsive bid from Test and Balance firms indicated. No other firms shall be used without Owner's written approval.

C. Contractor/CM will coordinate and administer TAB vendor's work.

D. Scope of TAB work is indicated in Part 3 - Execution.

1.2 RELATED SECTIONS

A. Section 01 31 00, "Project Coordination"

B. Section 01 33 00, "Submittal Procedures".

C. Section 01 42 00, "References".

D. Section 01 45 00, "Quality Control".

E. Section 01 78 00, "Closeout Submittals".

F. Section 01 91 00, "Commissioning".

G. Section 23 08 00, "Commissioning of HVAC".

1.3 REFERENCES

A. Comply with Section 01 42 00 - References for additional applicable references, abbreviations, definitions, and acronyms.

B. Florida Building, Mechanical and Plumbing Codes, 2023 (8th Edition).

C. Florida Fire Prevention Code, 2023 (8th Edition).

D. NEEB: Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems.

E. AABC: National Standards for Total System Balance.

F. ASHRAE: ASHRAE Application Handbook; latest edition: Testing, Adjusting, Balancing.

G. Sheet Metal and Air Conditioning Contractors National Association (SMACNA) - HVAC Systems Testing, Adjusting and Balancing (latest edition).

1.4 SUBMITTALS

A. Comply with Section 01 33 00 - Submittals.

B. Test and Balance contractors indicated herein to perform TAB work shall review Bid Documents and submit proposal to Contractor/Construction Manager at time of bidding indicated in Request for Proposals for Work.

C. Test and Balance vendor selected by Contractor/CM to perform TAB work for HVAC systems shall review and become familiar with project documents, review HVAC installation as work progresses and provide monthly progress reports to Owner indicating Contractor's/Construction Manager's HVAC work has been performed per Section 23 08 00, "Commissioning HVAC".

1.5 QUALIFICATIONS

A. Prequalified TAB Vendors:

1. Perfect Balance, Inc., 50 S. US Hwy One, Suite 307, Jupiter, FL 33477; P. O. Box 1584; Tel: 561-575-4919; Fax: 561-746-0726; Website: www.perfectbalanceinc.com. Contact: Bill Halm.

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2. Precision Air Balance, Inc., P. O. Box 101712, Cape Coral, FL 33910-1712; Tel: 239- 574-2400; Fax: 239-574-2400; Fax: 239-574-2400. Website: www.precision-air- balance.com. Contact: Mark Rusnock.
3. Bay To Bay Balancing, Inc., 933 Lee Rd., Suite 405, Orlando, FL 32810; Tel: 407- 704-8468; Fax: 407-704-8770; Email Address: Debbie@Bay2BAy.net.
4. Robert Shorr, CPMM, 13201 Collecting Canal Rd., Loxahatchee, FL 33470; 2428 Fawn Run, Oviedo, FL 32765; Tel: 561-351-0245; Fax: 561-855-8105. Email Address: Robert@tabfirm.com.

B. No other Test and Balance vendors are permitted to bid.

1.6 SCOPE OF SERVICES

A. Scope of services shall include:

1. Review project documents to verify that HVAC systems are designed so that TAB may be accomplished.
2. Provide pre-TAB inspections of HVAC systems during construction to assure that systems are installed in conformance with project documents and approved shop drawings.
3. Perform TAB of HVAC systems in accord with industry standard to assure correct air/water flow rates and energy efficient operation.
4. Provide certified TAB report of HVAC systems in accord with this Section.
5. Provide coordination of TAB activities between Design Mechanical Engineer, Mechanical Contractor, and Energy Management and Control System (EMCS) Contractor.
6. Initiate conference calls and/or schedule meetings to resolve TAB issues and document solutions to TAB issues.
7. If resolution is not possible or is not timely, schedule meeting(s) with appropriate parties and District staff (Project Manager).
8. Within 15 calendar days after receipt of Construction Documents, TAB Contractor shall review and provide written design review report of deficiencies (errors, omissions, conflicts, etc.) that would preclude TAB.
9. Schedule meeting(s) with Owner's Project Manager and Design Mechanical Engineer to resolve noted deficiencies.
10. Report shall address each item in Paragraphs 2.3 through 2.7 by itemizing each area reviewed and results.
11. Design Engineer shall incorporate resolution of reviewed items into Contract Documents prior to issuance to Contractor/Construction Manager.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 PRE-TAB INSPECTION

A. Coordinate inspection schedule with Mechanical Contractor and Owner's Commissioning HVAC Agent. Provide written inspection schedule. Note Commissioning inspection, Substantial Completion and Final Completion milestones on TAB schedule.

B. For each inspection, TAB vendor shall sign in and out either at District's field office or, if field office does not exist, at District Facilities offices located at 1050 East 10th St., Stuart, FL 34996.

C. Provide periodic inspections during construction and written pre-TAB punch lists within seven calendar days after each inspection. Frequency of inspections shall be determined by TAB vendor to provide adequate inspection coverage but shall not be less than monthly during HVAC system installation.

D. Inspection reports shall define area inspected and shall itemize TAB punch items.

E. Inspections shall include following areas:

1. Comply with Section 23 08 00, “Commissioning HVAC”.
2. Ductwork Systems (Outdoor, Supply, Return, Exhaust, Relief, etc.): Verify proper installation of duct fittings, balancing devices, access doors, turning vanes, transitions, flexible connections, etc.
3. Piping Systems (Chilled Water, Condenser Water, Make-up Water, etc.): Verify the proper installation of pipe fittings, balancing valves, Venturis, flexible connections, gage cocks, pressure gages, thermometers, etc.
4. HVAC Equipment: Verify that manufacturer, model number, power supply, motor horsepower, accessories, etc. are per approved shop drawings.
5. When shop drawings of different manufacturer than scheduled in project documents are approved, data per shop drawings shall be listed in TAB report as design data.
6. Verify that motor starter’s overload protectors are correct for motor’s rated load amperes.
7. Installation of HVAC Equipment: Verify that installation is per project documents and/or approved shop drawings.
8. Hydronic System Commissioning: Monitor cleaning, flushing, filling and chemical treatment.
9. Observe water samples being drawn and labeled. Advise Owner’s Project Manager if system commissioning is acceptable.
10. Obtain copy of chemical treatment test report and provide same in TAB report.
11. Distribute inspection schedule per Distribution List in Para. 3.2.C.
12. Distribute pre-TAB punch lists per the Distribution List in Para. 3.2.B.
13. Obtain complete set of approved HVAC shop drawings, addenda, architect supplement instructions, change orders, etc. from the Mechanical Contractor,
14. TAB vendor is responsible for scheduling meetings with Mechanical Contractor to obtain construction schedules for pre-TAB inspections and to resolve TAB punch items.
15. Verify automatic temperature controls are operational, equipment and duct access panels are securely closed, isolation and balancing valves are operational, ceilings, plenums, windows, and doors are closed or sealed for testing.

3.2 DISTRIBUTION LIST

A. Design Review Reports shall be emailed to following:

1. Design Mechanical Engineer.
2. Building Department.
3. Design Architect.
4. Owner’s Project Manager.
5. Owner’s Commissioning HVAC Agent.

B. Commissioning HVAC Equipment, Pre-TAB Inspection Schedule and TAB Work Schedule:

1. Owner’s Project Manager.
2. Owner’s TAB.
3. Owner’s Commissioning HVAC Agent. Information shall be used to verify Contractor’s compliance with Contract Documents.
4. Design Architect.
5. Design Mechanical Engineer.
6. Provide copy of schedules to General Contractor/CM.

7. Provide copy of schedules to Mechanical Contractor.

C. TAB Inspection Punch Lists and TAB Work Punch Lists:
   1. Mechanical Contractor.
   2. Owner's Project Manager. This information shall be used to verify the compliance by the TAB vendor with the TAB Contract.
   3. Design Mechanical Engineer.
   4. Design Architect.
   5. General Contractor/CM.

D. TAB Report, Monthly Status Reports and Revised TAB Test Reports:
   1. Owner's Project Manager. Provide 6 copies of Final TAB Report (one copy of other reports).
   2. Building Department.
   3. Design Architect.
   4. Design Mechanical Engineer.
   5. General Contractor/CM.
   6. Mechanical Contractor.

3.3 TAB WORK

A. Coordinate TAB work schedule with Mechanical Contractor and provide written TAB work schedule. Note Substantial Completion and Final Completion milestones on TAB schedule.

B. For each visit to project site, TAB vendor shall sign in and out either at District's field office or, if field office does not exist, at District's Facilities Administrative office.

C. Provide written punch lists summarizing non-complying items as soon as they are discovered, but at least weekly. Punch lists shall clearly delineate responsible party (Mechanical Contractor or Design Mechanical Engineer) for each punch item.

D. Punch items, relative to system performance, shall be documented by providing TAB test reports and plotting measured data on equipment performance curves. Punch items are responsibility of Design Mechanical Engineer if HVAC systems have been installed per project documents and approved shop drawings.

E. TAB vendor shall coordinate with responsible party (Mechanical Contractor or Design Mechanical Engineer) to resolve punch items. However, resolution that modifies the HVAC system design, operational modes or performance levels shall be approved, in writing, by Owner's Project Manager.

F. After written notification of punch list repairs by Mechanical Contractor, TAB vendor shall provide one re-TAB per item within contract. Additional TAB fees due to repeat TAB punch items and retesting are responsibility of Mechanical Contractor.

G. TAB vendor shall be responsible to clearly document additional fees and to provide documentation to Owner's Project Manager. Documentation that is unclear, inaccurate, or untimely will not be accepted.

H. Provide personnel on continuous basis in order to complete TAB work in timely manner.

I. Every effort shall be made to complete TAB work before District occupancy and/or Substantial Completion. After Owner's occupancy, access to site may be restricted. Work schedules shall be modified accordingly. Work after normal business hours shall be coordinated with Owner's Project Manager.

J. Immediately inform Owner's Project Manager of work progress, work schedules and potential problem areas, which may delay timely completion of TAB work.

K. Distribute TAB work schedule and punch lists per Distribution List in Para. 3.02.

L. TAB vendor is responsible for scheduling meetings with appropriate parties to obtain construction schedules for TAB work and to resolve TAB punch items.

M. Data for non-complying systems shall be provided so that affected parties are working with same information to outstanding punch items.

N. Coordinate with Mechanical Contractor and Design Mechanical Engineer in order to resolve TAB punch items and provide written monthly status report.

O. Provide revised TAB test reports for incorporation into TAB report within 15 calendar days after outstanding punch items have been resolved.

P. Punch items shall be resolved, and TAB report shall be completed prior to Final Completion.

Q. Distribute TAB report, monthly status reports and revised TAB test reports perthe Distribution List in Para.3.02.

3.4 VERIFICATION OF MEASUREMENTS

A. Owner shall have option of requesting verification of measurements in TAB report. Measurement verification shall involve 10% or less of measurements in TAB report.

B. Owner shall select measurements to be verified and TAB Contractor shall retest, in presence of the Owner's Project Manager, those measurements.

C. To pass measurement verification, at least 90% of those measurements shall be within acceptable tolerance of Design value.

D. Measurements that are out-of-tolerance shall be re-balanced to within acceptable tolerances.

E. If measurement verification fails, TAB Contractor shall rebalance systems at no additional cost to District. Measurement verification shall be repeated with another set of measurements that shall be selected by Owner.

F. TAB Contractor shall provide revised TAB test reports for the re-balanced systems within 15 calendar days of measurement verification. Distribute revised TAB test reports according to Distribution Lists in Para. 3.2.

3.5 TAB REPORT REQUIREMENTS

B. Publish TAB report within 15 calendar days after Substantial Completion. Publishing of TAB report shall not be delayed for unresolved punch items.

C. Distribute TAB report, monthly status reports and revised TAB test reports per Distribution List in Para. 3.2.

D. Provide reports in hard cover, letter size, 3-ring binders with identification on front and binder. Include set of reduced HVAC floor plans with air outlets and equipment identified to correspond with test reports. Number pages, i.e., Page X of XX.

E. Provide report per following format:

1. Title Page.
2. Certification Page.
3. Table of Contents.
4. Summary of Non-complying Systems (ALL ITEMS).
    a. Itemize outstanding TAB punch items.
    b. Itemize out-of-tolerance parameters from each test report. (NO EXCEPTIONS).
5. Instrument Calibration Report.
6. Test reports for each building.
7. Test reports for the central cooling/heating plant.
8. Test reports for the chemical treatment of the hydronic systems.
9. Reduced set of HVAC floor plans (NO EXCEPTIONS).

F. Central Station Air Handler Units (AHU).

1. Air handler unit CFM may be determined either by totaling individual CFMs from supply air grilles or by supply air duct traverse.
2. If design CFM (within -5%) cannot be achieved, air handler unit CFM shall be verified by supply air duct traverse; return air duct traverse is not acceptable.
3. When duct traverse is utilized, provide Duct Traverse Report in TAB report and note traverse locations on reduced set of HVAC floor plans.
4. Adjust fan RPM until either design CFM (-5%/+10%) is obtained or motor is at rated FLA. Do not use motor service factor.
5. Plot TAB data on manufacturer's fan performance curve. Include fan performance curve in TAB report. The following information shall be provided:
    a. Plot design point
    b. Label data point DESIGN POINT.
    c. Plot measured CFM and RPM. Label data point OPERATING POINT.
    d. Plot system resistance curve.
6. If design CFM (-5%/+10%) cannot be obtained, provide specific recommendations in order to obtain design CFM.
7. Provide measured static pressure data at the following locations:
    a. Filter inlet pressure.
    b. Filter delta pressure.
    c. Coil (cooling/heating/reheat) delta pressure.
    d. Fan suction pressure.
    e. Fan discharge pressure. Determine value from fan performance curve based on CFM and RPM; measured values are not reliable.
    f. Provide Air Handler Unit Test Report.
    g. Provide Coil Test Report. Plot actual data on psychrometric chart and include psychrometric chart in TAB report. Provided following data:
        i. Plot outdoor air DB/WB temperature. Label data point (OA).
        ii. Plot return air DB/WB temperature. Label data point (RA).
        iii. Plot coil-entering air DB/WB temperature. Label data point (CEA).
        iv. Plot coil-leaving air DB/WB temperature. Label data point (CLA). (5) For draw-thru AHUs, the location of coil leaving air temperatures is after the coil but before the fan.
        v. Measured data, when plotted on a psychrometric chart, shall represent consistent HVAC system processes. Inconsistent measured data shall be redone.
    h. Provide Air Outlet Test Report. Note any outlet not within ± 10% of design CFM and outlet(s) with objectionable noise level.
    i. Define area served using both drawing room number and actual room number.
    j. For variable air volume systems, provide Variable Air Volume Box Test Report.
8. Provide test reports and data in following order:
    a. Air Handler Unit Test Report.
    b. Fan Performance Curve.
    c. Coil Test Report.

d. Psychrometric Chart.

e. Air Outlet Test Report.

f. Variable Air Volume Box Test Report.

g. Duct Traverse Reports.

3.6 FANS (OUTDOOR, SUPPLY, EXHAUST, RELIEF, ETC.)

A. Provide test reports in following order:

1. Fan Test Report.
2. Air Outlet Test Report: Provide for fans with multiple supply and/or exhaust grilles. Note outlet(s) with objectionable noise level.

B. Adjust fan RPM until either design CFM (-5%/+10%) is obtained or motor is at rated FLA. Do not use motor service factor.

C. If design CFM (-5%/+10%) cannot be obtained, provide fan suction and discharge static pressures to determine external static pressure.

D. If design CFM (-5%/+10%) cannot be obtained, provide specific recommendations in order to obtain design CFM.

3.7 PUMPS (PRIMARY CHILLED WATER, SECONDARY CHILLED WATER, CONDENSER WATER, HOT WATER, ETC.)

A. Determine pump head using pump flange gage taps in order for TAB data to correlate with the pump performance curve.

B. Determine GPM using venturi. Provide venturi diameter and differential head.

C. Adjust system-balancing valves (coils and pump discharge) until either design GPM (-5%/+10%) is obtained or motor is at rated FLA. Do not use motor service factor.

D. Plot TAB data on manufacturer's pump performance curve. Include performance curve in TAB report. Provide following information:

1. Plot valve shut head.
2. Plot valve open head and GPM. Verify motor will not overload.
3. Plot impeller curve.
4. Plot final operating head and GPM. Label data point OPERATING POINT.
5. Plot design head and GPM. Label data point DESIGN POINT.
6. Plot system-operating curve.

E. If design GPM (-5%/+10%) cannot be obtained, provide specific recommendations in order to obtain design GPM.

F. Provide test reports and data in the following order:

1. Pump Test Report.
2. Pump Performance Curve.

G. Water Coils: Adjust individual coils to within ± 10% of design GPM, as long as total system water flow is within -5%/+10% of design GPM.

H. Noise

1. Provide Acoustical Test Report (8.10.X) for those areas that, during TAB work, appear to have an objectionable noise level.
2. Plot octave band acoustical data on NC curves in order to identify problem frequencies and to quantify the level of attenuation required.
3. For student occupied areas, NC levels shall be NC35 or less.

I. Venturis: Provide calibration charts (GPM versus differential head loss) in TAB report.

J. Balancing Valves and Combination Balancing/Shutoff Valves

1. Valves used to set GPM shall have adjustable memory stops.
2. Permanently mark the final position of each memory stop.

K. Volume Dampers.

1. Dampers used to set CFM shall have locking quadrants.
2. Permanently mark the final position of each locking quadrant.
3. For externally insulated ducts, all volume dampers shall have 2 inches high standoffs for locking quadrants.

3.8 REPORT FORMS

A. Each test report shall bear name of person who recorded data, date when data was recorded, and licensed professional seal of supervisor.

B. Test reports shall be computer generated and shall provide all data listed, as well as any required data not listed.

C. Title Page shall include following information:

1. Date.
2. Project's name and address.
3. Project number (SBMC).
4. Architect's name and address.
5. Design Mechanical Engineer's name and address.
6. General Contractor's name and address.
7. Mechanical Contractor's name and address.
8. TAB Contractor's name, address and phone number.

D. Certification Page

1. Project's name and address.
2. Certification statement.
3. TAB Contractor's name.
4. TAB Supervisor's name.
5. Certification number.
6. Date.
7. Seal and signature of TAB Supervisor.

E. Instrument Calibration Report

1. Instrument.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Range.
6. Calibration date.

F. Central Station Air Handler Unit Test Report

1. Air Handler Unit Data.
    a. Drawing Unit Symbol and Number.

b. Manufacturer, model number and serial Number.
c. Wheel type: Forward curve (FC), airfoil (AF), backward incline (BI).
d. Wheel diameter (IN).
e. Fan arrangement: Draw thru (DT), blow thru (BT).
f. Fan discharge: Upblast front (UBF), upblast rear (UBR), top horizontal (TH), bottom horizontal (BH).
g. Number of fan belts, manufacturer and size.
h. Number of filters, type and size.
i. Note if the filter pull strip and spacers are installed. If there are obvious leak paths around filters, AHU is not acceptable until leaks are repaired.

2. Motor Data.
a. Manufacturer.
b. Frame size.
c. Nameplate HP, volts, amps, phase, RPM and service factor.
d. Starter size and overload element capacity in amps.

3. Performance Data (Design and Actual).
a. Supply air CFM.
b. Outside air CFM.
c. Fan RPM.
d. Motor volts T1-T2, T2-T3, T3-T1.
e. Motor FLA T1, T1, T3.
f. Fan total static pressure, IN WC.
g. Fan suction static pressure, IN WC (Actual).
h. Fan discharge static pressure, IN WC (Actual). Refer to Article 8.2, A.5.e.
i. Filter static pressure loss, IN WC.
j. Cooling coil static pressure loss, IN WC.
k. Heating coil static pressure loss, IN WC.
l. Reheat coil static pressure loss, IN WC.
m. AHU casing static pressure loss, IN WC.
n. External static pressure loss, IN WC.
o. Inlet guide vane position at design CFM (Actual).
p. Variable speed drive output at design CFM (Actual).
q. Note any abnormal vibration.

G. Coil Test Report.
1. Coil Data.
a. AHU Drawing Unit Symbol and Number.
b. Number of rows and fins per foot.
c. Coil CFM.
d. Face area, SF.
e. Face velocity, FPM.

2. Air-side Performance Data (Design and Actual).

a. Outside air CFM.
b. Outside air DB and WB temperatures, °F.
c. Return air CFM.
d. Return air DB and WB temperatures, °F.
e. Coil CFM.
f. Coil entering air DB and WB temperatures, °F.
g. Coil leaving air DB and WB temperatures, °F.
h. Calculate coil capacity, BTUH (=4.5*CFM*DH).

3. Water-side Performance Data (Design and Actual).
a. Coil GPM.
b. Coil entering water temperature, °F.
c. Coil leaving water temperature, °F.
d. Coil head loss, FT (=2.31*PSID).
e. Venturi diameter, IN (Actual).
f. Venturi differential head, IN WC (Actual).
g. Calculate coil capacity, BTUH (=500*GPM*DT).

H. Fan (Outdoor, Supply, Exhaust, Relief, etc.) Test Report.
1. Fan Data.
a. Drawing Unit Symbol and Number.
b. Manufacturer, model number and serial number.
c. Type: Ceiling, inline, roof, wall.
d. Wheel type: Forward curve (FC), airfoil (AF), backward incline (BI).
e. Wheel diameter, IN.
f. Number of belts, manufacturer, and size.

2. Motor Data.
a. Manufacturer.
b. Frame size.
c. Nameplate HP, volts, amps, phase, RPM and service factor.
d. Starter size and overload element capacity, amps.

3. Performance Data (Design and Actual).
a. CFM.
b. Fan RPM.
c. Fan suction static pressure, IN WC (Actual).
d. Fan discharge static pressure, IN WC (Actual).
e. Fan total static pressure, IN WC.
f. Motor volts T1-T2, T2-T3, T3-T1.
g. Motor FLA T1, T2, T3.
h. Note any abnormal vibration.

I. Air Outlet Test Report.
1. Outlet Data.

a. Drawing Unit Symbol and Number.
b. Manufacturer.
c. Drawing and actual room numbers (both room numbers).
d. Type: Ceiling diffuser (CD), sidewall grille (SWG), exhaust grille (EG), return grille (RG), transfer grille (TG), etc.
e. Size, IN.

2. Performance Data.
a. Design CFM.
b. Actual CFM.
c. Note all outlets that are not balanced within ±10% of design. (Actual CFM- Design CFM)/ Design CFM)*100.
d. Note outlets with an objectionable noise level greater than 35 db in classrooms.

J. Duct Heater Test Report.
1. Unit Data.
a. Drawing Unit Symbol and Number.
b. Manufacturer, model number and serial number.
c. Design KW, volts, amps, phase and number of steps.
2. Performance Data (Actual).
a. Volts T1-T2, T2-T3, T3-T1.
b. Amps T1, T2, T3.

K. Unit Ventilator/Fan Coil Unit Test Report.
1. Unit Data.
a. Drawing Unit Symbol and Number.
b. Manufacturer, model number and serial number.
c. Control valve: 2-way or 3-way, 2-position or modulating.
d. Fan motor nameplate HP, volts, amps, phase, RPM and service factor.
e. Electric heater KW, volts, amps, phase and number of steps.
2. Performance Data (Design and Actual).
a. Outside air CFM.
b. Fan motor volts T1-T2, T2-T3, T3-T1.
c. Fan motor FLA T1, T2, T3.
d. Coil GPM.
e. Coil entering water temperature, °F.
f. Coil leaving water temperature, °F.
g. Venturi size, IN (Actual).
h. Venturi differential head, IN WC (Actual).
i. Heater volts T1-T2, T2-T3, T3-T1.
j. Heater amps T1, T2, T3.

L. Pump Test Report.
1. Pump Data.
a. Drawing Unit Symbol and Number.

b. Manufacturer, model number and serial number.
c. Design GPM, head, RPM and impeller diameter.
d. Required NPSH.
e. Seal type.

2. Motor Data.
a. Manufacturer.
b. Frame size.
c. Nameplate HP, volts, amps, phase, RPM and service factor.
d. Starter size and overload element capacity, amps.

3. Performance Data.
a. Valve shut differential head, FT.
b. Actual impeller diameter, IN.
c. Valve open differential head FT. Verify motor will not overload.
d. Valve open GPM.
e. Final suction pressure, PSIG.
f. Final discharge pressure, PSIG.
g. Final pump head, FT (=2.31*PSIG).
h. Final pump GPM.
i. Motor volts T1-T2, T2-T3, T3-T1.
j. Motor amps T1, T2, T3.
k. Note any abnormal vibration.

M. Duct Traverse Test Report.
1. Duct Data.
a. System/Branch.
b. Size, IN.
c. Area, SF.
d. Design airflow, CFM.
e. Design velocity, FPM.

2. Traverse Data.
a. Duct static pressure, IN WC.
b. Air temperature, °F.
c. Traverse position, IN.
d. Traverse velocity pressure, IN WC.
e. Traverse velocity, FPM.
f. Average duct velocity, FPM.
g. Measured airflow, CFM.

N. Chiller Test Report.
1. Chiller Data.
a. Drawing Unit Symbol and Number.
b. Manufacturer, model number and serial number.

c. Chiller volts, amps and phase.
d. Starter size and overload element capacity, amps.

2. Evaporator Data (Design and Actual).
   a. CHW temperature set point, °F.
   b. Entering/leaving CHW temperature, °F.
   c. Entering/leaving CHW pressure, PSIG.
   d. Differential CHW head, FT (=2.31*PSID).
   e. GPM.
   f. Capacity, TONS (=GPM*DT/24).
   g. Note: Test each chiller at full load.
3. Compressor Data (Design and Actual).
   a. Manufacturer, model number and serial number.
   b. Volts T1-T2, T2-T3, T3-T1.
   c. Amps T1-T2, T2-T3, T3-T1.
4. Air Cooled Condenser Data (Design and Actual).
   a. Number of fans.
   b. Fan motor HP, volts, amps and phase.
   c. Ambient temperature, °F.
5. Water Cooled Condenser Data (Design and Actual).
   a. Entering/leaving CW temperature, °F.
   b. Entering/leaving CW pressure, PSIG.
   c. Differential CW head, FT (=2.31*PSID).
   d. GPM.

O. Cooling Tower Test Report.
1. Cooling Tower Data.
   a. Drawing Unit Symbol and Number.
   b. Manufacturer, model number and serial number.
   c. Fan motor HP, volts, amps, RPM, phase, and service factor.
   d. Starter size and overload element capacity, amps.
   e. Number of fan belts, manufacturer, and size.
2. Performance Data (Design and Actual).
   a. Abnormal vibration.
   b. Entering/leaving CW temperature, °F.
   c. Design WB temperature, °F.
   d. Ambient DB/WB temperatures, °F.
   e. GPM.
   f. Fan motor volts T1-T2, T2-T3, T3-T1.
   g. Fan motor amps T1-T2, T2-T3, T3-T1.
3. Note any Temperature Control System Data (Actual).
   a. Single speed fan: Aquastat set point (°F) for fan on/off.

b. Two speed fans: Aquastat set points (°F) for fan high/low/off.

P. Heat Exchanger Test Report.

4. Heat Exchanger Data.
   a. Drawing Unit Symbol and.
   b. Manufacturer, model number and serial number.
   c. Design capacity, BTUH.
   d. Primary/secondary fluids.
5. Performance Data (Design and Actual).
   a. Primary entering/leaving temperatures, °F.
   b. Primary entering/leaving pressures, PSIG.
   c. Primary differential head, FT (=2.31*PSID).
   d. Primary GPM.
   e. Calculate primary capacity, BTUH (=500*GPM*DT).
   f. Secondary entering/leaving temperatures, °F.
   g. Secondary entering/leaving pressures, PSIG.
   h. Secondary differential head, FT (=2.31*PSID).
   i. Secondary GPM.
   j. Calculate secondary capacity, BTUH (=500*GPM *DT).

Q. Variable Air Volume Box Test Report.

1. Box Data.
   a. Drawing Unit Symbol and Number.
   b. Manufacturer, model number and serial number.
   c. Fan HP, volts, amps and phase.
   d. Heater KW, volts, amps, phase and number of steps.
2. Performance Data (Design and Actual).
   a. Cooling CFM: Primary maximum/minimum.
   b. Heating CFM: Primary minimum/secondary/total.
   c. Heater volts T1-T2, T2-T3, T3-T1.
   d. Heater amps T1, T2, T3.
   e. Fan volts T1-T2.
   f. Fan amps T1.

R. Boiler (Space Heating) Test Report.

1. Unit Data.
   a. Drawing Unit Symbol and Number.
   b. Manufacturer, model number and serial number.
   c. Type.
   d. Fuel.
   e. Number of passes.
   f. Ignition type.
   g. Burner control.

h. Power supply volts, amps and phase.

i. Input/output, MBH.

2. Performance Data (Design and Actual)

a. Entering/leaving HW temperatures, °F.

b. Entering/leaving HW pressures, PSIG.

c. Differential water head, FT (=2.31*PSID).

d. GPM.

e. Volts T1-T2, T2-T3, T3-T1.

f. Amps T1, T2, T3.

S. Make-up Water System Test Report.

1. Backflow Preventer.

a. Manufacturer and model number.

b. Type: Backflow preventer shall be reduced pressure type.

c. Size, IN.

d. Discharge funnel/air gap shall be installed.

e. Discharge shall be piped to a floor drain (interior location) or to 12 inch AFG (exterior location).

2. Pressure Regulating Valve.

a. Manufacturer and model number.

b. Set point, PSI. Refer to Article 8.10, S.1.c.

c. Size, IN.

3. Pressure Relief Valve.

a. Manufacturer and model number.

b. Set point, PSI.

c. Size, IN.

d. Discharge shall be piped to a floor drain (interior location) or to 12 inch AFG (exterior location).

T. Expansion Tank Test Report

1. Full Acceptance Bladder Expansion Tank.

a. Manufacturer and model number.

b. Acceptance tank volume, GAL.

c. Pre-charged pressure, PSIG. Set point of the pressure-regulating valve shall be equal to the tank pre-charge pressure.

2. Diaphragm expansion tanks are not acceptable.

3. Closed compression tanks are not acceptable.

U. Surface Heater Test Report.

1. Unit Data.

a. Mark.

b. Manufacturer, model number and serial number.

c. Design KW, volts, amps and phase.

2. Performance Data (Actual).

d. Volts T1-T2, T2-T3, T3-T1.
e. Amps T1, T2, T3.

V. Rooftop Unit Test Report.
1. Unit Data.
a. Mark.
b. Manufacturer, model number and serial number.
c. Number of filters, type and size.
2. Evaporator Fan and Motor Data.
a. Motor nameplate HP, volts, amps, phase, RPM, and service factor.
b. Number of fan belts, manufacturer, and size.
3. Evaporator Fan Data (Design and Actual).
a. Supply air CFM.
b. Outside air CFM.
c. Fan RPM.
d. Motor volts T1-T2, T2-T3, T3-T1.
e. Motor amps T1, T2, T3.
f. Fan total static pressure, IN WC.
g. Fan suction static pressure, IN WC (actual).
h. Fan discharge static pressure, IN WC (actual). Determine value from fan curve based on CFM and RPM. Refer to Article 8.2, A.5.e.
i. External static pressure, IN WC.
j. Note any abnormal vibration.
4. Evaporator Coil Data (Design and Actual).
a. Coil CFM.
b. Coil entering air DB/WB temperatures, °F.
c. Coil leaving air DB/WB temperatures, °F.
d. Coil capacity, BTUH (=4.5*CFM*DH).
e. Coil circuiting: row split (intertwined) or face split.
5. Condensing Unit Data (Design and Actual).
a. Number of compressors/circuits.
b. Ambient temperature, °F.
c. Compressor volts T1-T2, T2-T3, T3-T1.
d. Compressor amps T1, T2, T3.
e. Number of condenser fans (Actual).
f. Condenser fan HP, volts, amps, phase, RPM (Actual).
6. Heater Data (Design and Actual).
a. KW (Design).
b. Volts T1-T2, T2-T3, T3-T1.
c. Amps T1, T2, T3.
d. Number of steps.

W. Condensing Unit Test Report.
   1. Unit Data.
      a. Drawing Unit Symbol and Number.
      b. Manufacturer, model number and serial number.
      c. Number of compressors/circuits.
   2. Compressor Data.
      a. Ambient temperature, °F.
      b. Compressor volts T1-T2, T2-T3, T3-T1.
      c. Compressor amps T1, T2, T3.
   3. Condenser Fan Data.
      a. Number of fans.
      b. Fan HP, volts, amps, phase, and RPM.

X. Packaged Terminal Air Conditioner Test Report.
   1. Drawing Unit Symbol and Number.
   2. Manufacturer, model number and serial number.
   3. Nameplate volts, amps and phase.
   4. Outside air CFM.
   5. Nameplate cooling capacity, BTUH.
   6. Cooling mode volts and amps.
   7. Nameplate heating capacity, KW.
   8. Heating mode volts and amps.

Y. Acoustical Test Report.
   1. Indicate reference to Drawing Sheet Number and FISH room number for each space tested.
   2. Noise level (dB re 10-12W) by octave band (63 Hz, 125 Hz, 250 Hz, 500 Hz, 1000 Hz, 2000 Hz, 4000 Hz, 8000 Hz).
   3. Plot noise levels on NC curve.
   4. Note which systems are not within acceptable tolerance (NC35 or less in student occupied areas).

END OF SECTION

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SECTION 23 07 00 - HVAC INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Duct Systems Insulation.

B. Piping Systems Insulation.

C. Equipment Insulation.

D. Underground Pipe Insulation.

E. Cold Pipe Hanger Support Blocks.

F. Accessories.

1.3 QUALITY ASSURANCE

A. All products within the conditioned air stream or active plenums shall comply with the NFPA 90A Flame/Smoke rating of 25/50 and comply with UL 181 erosion limitations. Fire hazard ratings shall be as determined by NFPA-255, "Method of Test of Surface Burning Characteristics of Building Materials" - ASTM E84 or UL 723.

B. All adhesives, cements, finishes, jackets, etc., shall be UL listed or labeled for use as applied to insulation and designed specifically for use in the installation.

C. All insulation shall be installed in accordance with National Commercial & Industrial Insulation Standards (NCIA).

D. Kitchen hood exhaust duct fireproofing system shall have specific acceptance by ICBO, and SBCCI. Material shall be non-hazardous and contain no asbestos or toxic materials. Suitable for 2-hour fire rating.

1.4 SUBMITTALS

A. Submit schedule indicating type of insulation, thickness, vapor barrier or coating by system and size.

B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

C. Submit details of insulated removable covers using the actual equipment dimensions, concrete base sizes and piping arrangements.

D. Submit in accordance with Division 1 requirements.

1.5 GENERAL REQUIREMENTS

A. Factory-applied insulation is specified under the applicable equipment Section of these specifications. It is listed here for reference only.

B. Acoustical duct liner is specified under Section 23 31 01 - Shop Fabricated Ductwork. It is listed here for reference only.

C. Packages and standard containers of materials shall be delivered unopened to job site and shall have the manufacturer's label attached giving a complete description of the material.

1.6 DEFINITIONS

A. The term "exposed" means exposed to view in finished spaces, in equipment rooms, in fan rooms, in closets, in utility corridors, in tunnels, on roof, in storage rooms, and in other spaces as indicated.

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B. The term "concealed" means concealed from view, and includes all spaces not defined as exposed.

C. The term "unconditioned" space shall mean all places where the temperature surrounding the pipe or duct has not been conditioned consistent with conditioned spaces, and shall include mechanical equipment rooms, non-active ceiling plenums, and non-accessible chases. This term shall also include conditioned spaces where the humidity levels are allowed to rise above 65% RH.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Fiberglass Insulation:
   1. Owens-Corning Fiberglas
   2. Knauf Fiberglass
   3. CertainTeed
   4. Johns Manville

B. Closed Cell Elastomeric Insulation:
   1. Armacell LLC
   2. Johns Manville
   3. Rubatex

C. Foamglass Insulation:
   1. Pittsburgh Corning
   2. Cell-U-Foam Corp.

2.2 DUCT INSULATION AND FIREPROOFING REQUIREMENTS

A. Refer to the drawings for insulation size and type requirements. Please contact the engineer prior to bid with any questions regarding the insulation requirements.

2.3 PIPE INSULATION REQUIREMENTS

A. Refer to Section 23 02 00 for PVC jacket color specifications requirements on all piping exposed or concealed.

2.4 MATERIALS

A. Duct Insulation: Blanket Fiberglass: Flexible fibrous glass, flame retardant factory laminated foil-skrim-kraft (FSK) vapor barrier, 2" stapling flange, maximum vapor permeance of .02 perm/in., minimum density of 1.5 lb/cf, maximum conductivity per 1" thickness of .28 at 75°F mean temperature. Based on Knauf Duct Wrap.

B. Pipe Insulation (to 450-deg F):
   1. Rigid Fiberglass: Resin bonded fibrous glass, flame retardant, factory applied all service jacket vapor barrier with self-sealing pressure sensitive lap joints, molded to accommodate pipe, maximum vapor permeance of .02 perm/in. and a puncture resistance of 50 units, minimum density 4.0 lb/cf, maximum conductivity per 1" thickness of .23 at 75°F, .29 at 200°F and .43 at 400°F mean temperature. Based on Knauf Pipe Insulation.
   2. Closed Cell Elastomeric (Small Pipe Sizes up to 5 Inches): Flexible, elastomeric, closed cellular, tubular molded to accommodate piping, smooth outer surface suitable for painting with vinyl lacquer type coating, water resistant, non-absorbent, ozone resistant, minimum density of 4 lb/cf, maximum conductivity per 1" thickness of .27 at 75°F mean temperature. Based on Armacell LLC AP Armaflex and Self-seal Armaflex 2000.
   3. Closed Cell Elastomeric (Large Pipe Sizes, 6" and Larger): Sheet type, flexible, elastomeric, closed cellular, smooth outer surface suitable for painting with vinyl lacquer type coating, water resistant, non-absorbent, ozone resistant, minimum density of 4 lb/cf,

maximum conductivity per 1" thickness of 2.7 at 75°F mean temperature. Based on Armacell LLC Armaflex II.

4. Foamglas: Rigid, preformed sections of 100% rigid cellular glass dimensionally complying with ASTM C585 standards, non-absorptive of moisture after immersion, water vapor permeability 0.00 perm/in. impervious to common acids (except hydrofluoric),

   non-combustible, 100 PSI compressive strength when capped with hot asphalt, 8.5 #/cu.ft. density, thermal conductivity 0.33 BTU-In./Hr./Sq.Ft./F @ 50°F. Based on Pittsburgh Corning Foamglas.

C. Equipment Insulation:

1. Closed Cell Elastomeric Sheet type, flexible, elastomeric, closed cellular, smooth outer surface suitable for painting with vinyl lacquer type coating, water resistant, non-absorbent, ozone resistant, minimum density of 6 lb/cf, maximum conductivity per 1" thickness of .27 at 75-degree F mean temperature. Based on Armacell LLC Armaflex II.
2. Foamglas: Sections of 100% rigid cellular glass, non-absorptive of moisture after immersion, water vapor permeability 0.00 perm/in., impervious to common acids (except hydrofluoric), non-combustible, 100 PSI compressive strength when capped with hot asphalt, 8.5 #/cu.ft. density, thermal conductivity 0.32 BTU-In/Hr./Sq.Ft./F @ 50°F. Based on Pittsburgh Corning Foamglas.

D. Insulation Accessories: Aluminum Pipe Jacket and Fitting Covers: Jacket shall be 0.016" thick (26 gauge) embossed aluminum, sized to provide a 2" (min.) lap joint both longitudinally and circumferentially, with 3/4" min. wide x 0.015" min. (30 gauge) thick draw bands. Fitting covers shall be aluminum, 0.025" (22 gauge), min., thickness.

E. Cold Pipe Hanger Support Blocks: Lightweight, rigid, closed cell material having 100 lb/sq.in. compressive strength when capped with hot asphalt according to ASTM C240. Based on Pittsburgh Corning Foamglas.

F. Accessories:

1. Aluminum Pipe Jacket and Fitting Covers: Jacket .016" thick (28 ga.) embossed aluminum sized to provide a minimum 2" lap joint both longitudinal and circumferentially, minimum 3/4-inch x .015-inch thick (30 ga) draw bands. Covers .024 inch thick.
2. PVC pipe jacket and fitting covers used with insulation for pipe, elbows, tees, couplings, 25/50 flame/smoke ratings, suitable for temperatures to 500°F.
3. Glass Cloth Pipe, Duct and Equipment Jacket: Glass lagging cloth, 8 oz/sy treated weight. Secure with elastomeric insulating adhesive on elastomeric insulation, for fiberglass insulation use appropriate mastic finish as recommended by the insulation manufacturer with the perm rating of the mastic equal to or less than that of the insulation it is sealing.
4. Corner angles shall be minimum 28-gauge, 1 inch by 1 inch aluminum adhered to 2-inch by 2-inch heavy kraft paper.
5. Glass tape shall be a minimum density of 1.6 ounces per square yard, 4 inch wide with a 10 x 10 thread count per inch of width. Glass cloth shall be untreated.
6. Staples shall be outward clinching type, Type 304 or 316 stainless steel in accord with ASTM A 167 or Monel® coated.
7. Wire shall be soft annealed galvanized, or copper, 16 gauge, or nickel copper alloy.
8. Closed cell elastomeric insulated finish shall be a white water based flexible, acrylic latex enamel equal to WB Armaflex finish.
9. Insulation Tape: Closed cell elastomeric insulation: 2" wide x 1/8" thick.
10. Elastomeric Insulation Adhesive: Air drying contact adhesive for securing sheets to flat or curved metal surfaces and joining seams and butt joints of elastomeric insulation. Suitable

for temperatures to 180□F, dried film not to exceed 25 for flame spread and 50 for smoke development when tested per ASTM E 84-84A method.

11. Vapor Barrier Mastic: Air drying flexible water-based mastic used for applying a vapor barrier joint with glass cloth at insulation joints. Suitable for temperatures to 180°F, wet and dried film not to exceed 25 for flame spread and 50 for smoke development when tested per ASTM E 84-84A method. Maximum Perm rating of 0.08, Childers Products Company, Inc. CP-35 Chil Therm® WB, Foster Products Corp. Product Data 30-80 Foster Vapor Safe® Coating, Marathon Industries, Inc. 590 LO-PERM, Richard's Paint Manufacturing CO., Inc. VBM-4, Vimasco Corp. 749 Vapor-Blok, or equal.
12. Acrylic Latex Finish and Sealers:
    a. Elastomeric Insulations: Air drying flexible water-based finish used for finishing flexible elastomeric insulation. Suitable for temperatures to 180°F, wet and dried film not to exceed 25 for flame spread and 50 for smoke development when tested per ASTM E 84-84A method. Armacell LLC WB Armaflex finish.
    b. Foamglass Insulation: Air drying flexible water-based sealer used for applying a vapor barrier seal over microscopic cracks that develop in the insulation. Suitable for temperatures to 180°F, wet and dried film not to exceed 25 for flame spread and 50 for smoke development when tested per ASTM E 84-84A method. Maximum Perm rating of 0.08, Childers Products Company, Inc. CP-35 Chil Therm® WB, Foster Products Corp. Product Data 30-80 Foster Vapor Safe® Coating, Marathon Industries, Inc. 590 LO-PERM, Richard's Paint Manufacturing CO., Inc. VBM-4, Vimasco Corp. 749 Vapor-Blok, or equal.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Install all insulation in strict accordance with the manufacturers written installation instructions.

B. Provide a PVC jacket on all exposed rain leader piping, including but not limited to the Gym.

C. All insulation work shall be performed by skilled mechanics regularly engaged in the insulation trade.

D. Properly coordinate the insulation work with the other trades so that installation is performed with a minimum of conflict.

E. Insulation shall not be applied on any piping or duct system requiring testing until testing is completed and approved by Engineer.

F. Insulation shall not be applied until all systems are clean, dry, free of dirt, dust or grease.

G. The finished installation shall present a neat and acceptable appearance which includes but is not limited to: all jackets smooth, all vapor barriers sealed properly, no evidence of "ballooning" of the jackets, or sagging insulation, all valves, dampers, gauges, unions, etc. accessible. The Engineer shall be the final judge of acceptance of workmanship.

H. All equipment nameplates on hot equipment shall be left uncovered. All equipment nameplates on cold equipment shall have a removable section sized to expose the nameplate. This section shall be clearly marked "NAMEPLATE".

I. If proper maintenance procedures require access to the insulated equipment removable panels, sections or covers shall be provided to accomplish this. These access devices shall be constructed in a manner to assure easy access and sturdy construction. The contractor shall assume the responsibility to coordinate all equipment requiring insulation to be either factory or field insulated.

J. Insulation and accessories shall be applied only at suitable application temperature and conditions as recommended by the manufacturer. Do not apply insulation to any surface while it is wet.

K. Insulation shall be protected from moisture and weather during storage and installation.

L. Insulation which has sustained moisture damage, torn jackets, or other damage due to improper storage or other reasons shall not be used. If evidence of this is sighted the Owner's representative reserves the right to require the insulating contractor to remove any and/or all insulation until the Engineer is satisfied that there is no longer any inferior insulation installed on this project.

M. Insulation, fabric, and jacketing shall be protected from damage during construction. Damage by the insulator shall be repaired without cost to the Owner. Damage by others shall be reported in writing to the contractor.

N. The insulation subcontractor is responsible for proper material storage at the work site.

O. Work performed prior to receipt of approved documents or submittals, which later proves to be incorrect or inappropriate, shall be promptly replaced by the contractor without cost to the purchaser.

P. Insulation shall not be installed until adequate access and clearances at control mechanisms, dampers, sleeves, columns, and walls have been provided.

Q. All insulation at handholes, access doors or other openings, and adjacent to flanges and valves shall be neatly finished where exposed to view.

R. All materials, accessories and methods of installation and fabrication are subject to the Owner's Representatives inspection and approval during any phase of the work.

S. The insulation subcontractor shall prevent the accumulation of insulation debris in the buildings and on the premises of the Owner.

T. The insulation subcontractor shall be responsible for his own safety program at the work site and shall provide instruction on safe practices for his workers assigned to the project. All employees are subject to the work rules at the job site.

U. The insulation subcontractor shall familiarize himself with the progress and execution of the job and notify the proper parties of interferences and any problems with the proper installation of his materials.

3.2 INSTALLATION

A. Duct Insulation:

1. General:

a. Insulate or internally line all flexible duct connectors equal to or greater than adjacent insulation thickness.

b. The tops of all diffusers shall be insulated same as connecting ductwork to prevent condensation.

c. Duct insulation at fire dampers shall be extended over supporting angle iron and sealed to wall.

2. Blanket Fiberglass Insulation:

a. Insulation shall be tightly wrapped on the ductwork with all circumferential joints butted and longitudinal joints lapped 2 inches and stapled. Joints shall be finished with two coats of an approved vapor barrier mastic, reinforced with glass cloth extending 2 inches onto adjacent insulation. One coat of mastic shall be applied to the insulation prior to the application of the glass cloth, which shall be embedded in the mastic to ensure complete adhesion of the cloth. Additionally, secure insulation to bottom of rectangular ducts over 24 inches wide with weld pins at no more than 18-inches on center.

b. Insulation shall be butted with facing overlapping all joints shall be finished with two coats of an approved vapor barrier mastic, reinforced with glass cloth extending 2-inches onto adjacent insulation. One coat of mastic shall be applied to the insulation prior to the application of the glass cloth, which shall be embedded in the mastic to

ensure complete adhesion of the cloth. Breaks, punctures, pin penetrations in facing shall be sealed with vapor barrier tape and vapor barrier adhesive.

3. Rigid Fiberglass Insulation:
    a. Use boards in largest possible size to minimize seams. Do not use "scraps".
    b. Shall be installed in all non-public exposed areas up to 10’-0” above finished floor.
    c. Provide corner angles where insulation is subject to harm.
    d. All fasteners shall be non-corroding.
    e. The insulation shall be applied by use of cup head weld pins. Such fasteners shall be spaced in accordance with NCIA recommendations, where NCIA standards do not address exact dimensions, cup head weld pins shall be spaced on 12" centers. Pin caps shall be covered with a round vapor seal patch that matches the jacket on the ASJ board. On cold ducts, these shall be coated so as to not cause condensation.
    f. Ducts having sharp bends shall have the insulation scored as required to conform to the curved surfaces to provide a neat and acceptable appearance when finished.
    g. Insulation edges and joints shall be finished with two coats of an approved vapor barrier mastic, reinforced with glass cloth extending 2 inches onto adjacent insulation. One coat of mastic shall be applied to the insulation prior to the application of the glass cloth, which shall be embedded in the mastic to ensure complete adhesion of the cloth.
    h. Generally, rigid fiberglass material will only be used in finished or exposed areas, and it is intended that the finish present a neat and uniform appearance as to color and workmanship.
    i. In finished areas, molded glass fiber insulation shall be used to insulate round ducts where commercially available sizes can be used.
    j. Fittings on round ducts in finished areas shall be covered with pre-molded fiberglass fitting insulators equal to Insul-Coustic where sizes are available. For sizes where pre-molded fittings are not available use miter-cut segments of molded pipe insulation, wired in place, with all joints sealed with adhesive and smoothed out with a coat of insulating cement.
    k. On cold ducts, the fittings shall be finished with two coats of an approved vapor barrier mastic, reinforced with glass cloth extending 2 inches onto adjacent insulation. One coat of mastic shall be applied to the insulation prior to the application of the glass cloth, which shall be embedded in the mastic to ensure complete adhesion of the cloth. Hot ducts shall be finished in a similar manner, except the mastic need not be of the vapor barrier type.

B. Pipe Insulation:
1. General:
    a. All locations where the insulated surface is supported by hangers, the insulation shall be protected by shields or saddles properly skimmed to maintain a smooth outer surface, and proper insulation thickness. Chilled water piping, 3" and over shall have a section of Foamglas insulation installed between the pipe and shield. 3 and 4" to be 12" long, 5" and 6" to be 18" long and 8" and over, 24" long. If the possibility exists that the hanger may conduct the temperature of the conveyed medium and thus cause condensation or personal injury due to high temperature, the hanger shall also be insulated. Joints between Foamglas and pipe insulation shall be properly sealed.
    b. All devices connected to or in line with the piping system shall be insulated greater than or equal to the connecting piping. This includes but is not limited to valves, air separators, expansion tanks, control valves, control devices, gauge connections,

thermometer stems, chemical feed equipment, piping flexible connectors, etc. This is particularly important on ice water and refrigerant lines.

c. The insulation at threaded unions in steam and hot water piping shall be tapered and terminated with cement and glass lagging cloth and lagging adhesives.

d. Insulate exterior surfaces of all anchors and guides for chilled water and dual temperature piping systems.

e. A complete moisture and vapor barrier shall be installed wherever insulation is penetrated by hangers or other projections through insulation and in contact with cold surfaces for which a vapor seal is specified.\

f. Cover fittings, flanges, unions, valves, anchors, and accessories with pre-molded or segmented insulation of the same thickness and material as the adjoining pipe insulation. Where nesting size insulation is used overlap pipe insulation 2 inches or one pipe diameter. Fill voids with insulating cement and trowel smooth. Elbows shall have not less than 3 segments per elbow. Secure insulation with wire or tape until finish is applied. Blanket inserts in lieu of pre-molded or segmented insulation is not allowed. Cover fittings with preformed PVC fitting covers.

g. Wrap all pressure gauge taps, thermometer wells and all other penetrations through insulation with closed cell insulation tape so as to prevent condensation.

h. Seal all raw edges of insulation.

i. For piping supported by hangers outdoors, apply a rain shield to prevent water entry.

2. Rigid Fiberglass:

a. Provide PVC fitting covers for all fittings.

b. Align all jacket seams.

c. Assure all vapor barriers are properly sealed.

d. Provide PVC jacket over all exposed insulation in the equipment room.

e. All corner angles below 6’-10” shall have padded insulation and be marked with yellow stripes.

3. Closed Cell Elastomeric:

a. All joints shall be sealed with adhesives.

b. Where the thickness is to be obtained by use of two layers of insulation, install with staggered joints.

c. Finish:

i. Concealed Indoors: No additional finish.

ii. Exposed Indoors: Provide PVC jacket over all insulation.

iii. Concealed Indoors: Provide PVC jacket over fittings fabricated from insulation sections or sheet.

iv. Outdoors: Provide aluminum pipe jacket.

4. Foamglas:

a. All joints, both longitudinal and circumferential shall be sealed with a vapor barrier mastic.

b. Thickness shown for refrigeration pipe to be obtained by use of two layers of insulation with staggered joints.

c. Finish:

i. Exposed Indoors: Provide PVC jacket over all insulation that shall be sealed with an acrylic latex finish.

ii. Concealed: Provide PVC jacket over fittings fabricated from insulation sections or sheet. Provide ASJ over all other.

iii. Exposed Outdoors: Provide acrylic latex finish and aluminum pipe jacket.

C. Equipment Insulation:

1. Vessel and Large Pipe Insulation:

a. Insulation shall be of the same material as the piping which serves it, and it shall be layered to obtain the required thickness. Maximum of 1-1/2" thick per layer.

b. All joints shall be staggered to avoid thermal gaps.

c. Sheet size shall be as large as possible to minimize seams. Do not use "scraps".

d. Securing shall be by welded studs and/or non-corrosive banding wire. Do not weld brackets, clips or other devices to ASME coded pressure vessels or piping. Insulation pins or studs shall be as specified and installed in accordance with NCIA standards.

e. Finish shall be with PVC jacket or galvanized steel mesh wire and a finish coat of insulating cement minimum of 1/4" thick. After cement has cured apply glass lagging cloth and proper coating as directed by manufacturer. All corners shall have metal corner beads and provide acrylic latex finish.

2. Removable Covers:

a. Equipment specified to have removable covers shall have insulation as specified in Paragraph 2.4, fastened to the inside surfaces of a 20-gauge galvanized sheet metal equipment cover.

b. The covers shall be of a sectionalized design and shall be custom fitted around each piece of equipment. For ease of removal, joints between sections shall coincide with the splits or joints in the equipment. Joints between sections of the cover shall be held together with quick-connect trunk latches and shall be gasketed to form a vapor-tite seal cover (for the passage of pipes, etc.) shall be provided with closed cell elastomeric collars to ensure a tight fit.

c. The box shall be fitted around each piece of equipment and split for removal to coincide with the split in the casing. The sections of the box shall be held together with quick disconnect trunk latches. Joints between box sections shall be gasketed to form a vapor seal. Void spaces in the box shall be packed with flexible fiberglass insulation. Openings around pump casing shall be provided with closed cell elastomeric collar to ensure tight fit.

d. Provide acrylic latex finish.

e. Coordinate the piping of the drain, vent, gauge, and control lines to exit through the base or back section of the removable cover. The insulation of these pipes shall be totally independent of the removable cover.

3. Chilled Water Compression Tank and Filtering Systems: Surfaces shall be insulated with 1-inch-thick closed cell elastomeric insulation board or pipe insulation, as applicable. Finish as specified for vessel and large pipe insulation.

D. Cold Pipe Hanger Support Blocks:

1. Provide on all chilled fluid systems pipe hangers and supports.

2. Apply Pittcote 404 acrylic latex mastic filler over insulation and on ends.

3. Apply Pittseal 444 butyl joint and penetration sealant at joint between Foamglas and adjacent insulation.

4. Provide vapor barrier system to match the vapor barrier on the adjacent system.

5. Provide 20 gauge (min.) galvanized shield between the insulation and the hanger or support.

E. PVC Jacket:
   1. Provide PVC sheet jacket over all exposed, indoor piping or insulation.
   2. Provide PVC pipe jacket over all exposed, indoor Foamglas or elastomeric pipe insulation.
   3. Provide PVC fitting covers over all fittings fabricated from insulation sections or sheet material.
   4. PVC pipe jacket shall be applied with special attention given to achieving positive seal at all longitudinal and circumferential joints using a welding solvent on the longitudinal joint as recommended by the manufacturer. Slip joints to have 4" minimum lap and no welding solvent.

F. Glass Cloth Jacket:
   1. Provide where specified.
   2. Provide acrylic latex finish.

G. Flexible Acrylic Latex:
   1. Apply two coats to glass cloth jacket, concealed Foamglas and closed cell elastomeric insulation.
   2. Refer to Division 9 for color to be used. If no instructions are given, provide a white finish.

3.3 MISCELLANEOUS ITEMS

A. General: Provide insulation of any portion of a system or piece of equipment not previously discussed where ambient operating conditions will allow condensation to occur or whose surface temperature exceeds 115-deg F. Insulation materials and method shall be as directed by the Designer.

B. Final Inspection: At final inspection, the finished surfaces of all exposed insulation shall be clean and without stains or blemishes. Repair and clean the insulation surfaces and, if necessary, to obtain a new appearance, shall coat discolored surfaces with off-white latex water-base semi-gloss paint or lagging adhesive, without a change in the contract price.

END OF SECTION

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SECTION 23 08 00 - COMMISSIONING OF HVAC

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Independent commissioning of heating, ventilation, and air conditioning in accord with project documents and include:

1. Evaluate proposed HVAC and electrical systems design and control system documents.
2. Review and document HVAC and Electrical control interface systems interface.
3. Coordinate start-up of HVAC and Electrical systems.
4. Coordinate and review operation, training procedures, demonstration and instructions for HVAC equipment use by Owner.
5. Review, evaluate, and document HVAC equipment operation and performance.

B. Work with TAB contractor for testing, adjusting, and balancing to ensure HVAC system performance is maximized for operational efficiency.

C. Coordinate HVAC Commissioning scheduling and activities with GC/CM.

D. Commissioned Systems Include:

1. HVAC components and equipment.
2. HVAC interaction of cooling, heating, and comfort delivery systems.
3. Building Automation System (BAS): control hardware and software, sequences of operation, and integration of factory controls with BAS.
4. Plumbing: Domestic hot water systems.
5. Lighting Control System with interface with daylighting.

1.2 RELATED SECTIONS

A. Section 01 31 00, “Project Coordination”.

B. Section 01 33 00, “Submittal Procedures”.

C. Section 01 42 00, “References”.

D. Section 01 45 00, “Quality Control”.

E. Section 01 78 00, “Closeout Submittals”.

F. Section 01 91 00, “Commissioning”

G. Section 23 05 93, “Testing, Adjusting and Balancing For HVAC”.

1.3 REFERENCES

A. See Section 01 42 00 - References for additional reference standards, definitions, abbreviations, and acronyms.

B. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE):

1. ASHRAE Guideline 0-2005 with Amendments a, b, c & d - The Commissioning Process.
2. ASHRAE Guideline 1.1-2007, The HVAC Commissioning Process.
3. ASHRAE 110-95 - An Introduction to Laboratory Fume Hood Performance Testing.

C. NEBB Whole Building Systems Commissioning of New Construction, 2009 (3rd Edition).

D. American National Standards Institute/American Industrial Hygiene Association/American Society of Safety Engineers (ANSI/AIHA/ASSE):

1. ANSI/AIHA/ASSE Z9.5-2012 - American National Standard for Laboratory Ventilation.

1.4 DEFINITIONS

A. Definition of terms used are as follows:

1. Acceptance Phase: Phase of construction after initial start-up and check-out when functional performance testing, operational training, and operating and maintenance documentation development and review occurs.
2. Basis of Design: Documentation of primary thought processes and assumptions for design decisions made to meet Owner's Project Requirements as reflected in construction documents (drawings and specifications). Basis of design describes intent of project, systems, components, conditions, and methods chosen to meet Owner's Project Requirements. Design professionals (Architect and Engineer) are responsible for interpretation of the basis of design.
3. Commissioning Provider: Independent entity, not otherwise associated with design team or Contractor/CM, who directs and coordinates day-to-day commissioning activities. Commissioning Provider does not have construction oversight or design role.
4. Commissioning Plan: Overall plan providing structure, schedule, and coordination planning for commissioning process.
5. Commissioning Team: Group responsible for accomplishing commissioning process.
6. Data Logging: Monitoring flows, currents, status, and pressures of equipment using stand-alone recording equipment, separate from control system. Additional monitoring may be provided through capabilities of control system.
7. Deferred Functional Performance Tests: Functional tests performed after date of substantial completion due to partial occupancy, equipment and seasonal testing requirements, design or other site conditions precluding testing of system or piece of equipment during normal commissioning sequence.
8. Owner's Project Requirements: Documents prepared by Owner providing explanation of concepts, criteria, and work scope critical to Owner’s expectations.
9. Factory Testing: Testing of equipment at factory (or on-site) by factory personnel in Owner’s representative and commissioning agent’s presence.
10. Functional Performance Tests: Tests of dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Functional testing is dynamic testing of systems (rather than just components) under full operation. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied modes, varying outside air temperatures, fire alarm modes, and power failure. Systems are run through control system’s sequences of operation and components are verified to respond properly. Commissioning Provider develops Functional Performance Test procedures in sequential written form, coordinates, oversees and documents actual testing performed by GC/CM. Functional Performance Tests are performed after Test and Balance, pre-functional checklists and start-up is complete.
11. Indirect Indicators: Indicators of response or condition, such as reading from control system screen reporting damper to be 100% closed.
12. Manual Tests: Using hand-held instruments, immediate control system read-outs or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make observations.
13. Monitoring: Recording of parameters (flow, current, status, or pressure) of equipment operation using data loggers or trending capabilities of control systems.

14. Over-written Value: Writing over sensor value in control system to determine response of system (e.g., changing outside air temperature value from 50ºF to 75ºF to verify economizer operation). See “Simulated Signal.
15. Owner-contracted Tests: Tests paid by Owner outside GC/CM’s contract and for which Commissioning Provider does not oversee. Tests shall not be repeated during functional testing if properly documented.
16. Phased Commissioning: Commissioning completed in phases (by floors, for example) due to size of structure or other scheduling issues, to minimize total construction time.
17. Pre-functional Checklists: Lists of items to inspect and elementary component tests to conduct to verify proper installation of equipment, provided by GC/CM to Commissioning Authority who shall review and approve scope of tests. Pre-functional checklists are primarily static inspections and procedures to prepare equipment or system for initial operation (e.g., belt tension, oil levels, labels affixed, gauges in place, sensors calibrated). Some pre-functional checklist items may entail simple testing of function of components, piece of equipment or systems. Pre-functional refers to testing to be accomplished prior to formal functional testing of installed equipment. Pre-functional checklists augment and may be combined with manufacturer’s start-up checklist. GC/CM shall execute checklists.
18. Sampling: Functional Performance Testing of fraction of total number of identical or near identical pieces of equipment. Sampling population is at discretion of commissioning firm and is subject to modification based upon sampling results (i.e., will be expanded if initial results warrant).
19. Simulated Condition: Condition created for purpose of testing response of system (e.g., blowing hair dryer on space sensor to determine response of variable volume terminal unit).
20. Simulated Signal: Disconnecting sensor and using signal generator to send amperage, resistance or pressure to transducer and control system to simulate sensor value.
21. Start-up: Initial starting or activating of dynamic equipment, including executing pre-functional checklists.
22. Test, Adjust, and Balance: Process of measuring actual flows of air and hydronic systems, adjusting flows to required values, and documenting results.
23. Trending: Monitoring of equipment performance over time, using data logging equipment or building control system.

1.5 QUALITY ASSURANCE

A. Supervision, coordination, and documentation of commissioning process shall be responsibility of Commissioning Provider.

B. Commissioning Provider shall become familiar with Owner's Project Requirements, Basis of Design documentation, project documents, and shall assume responsibility for overall system commissioning effort.

C. Acceptable Commissioning Firms:

1. OCI Associates, Inc., 181 Melody Lane, Ft. Pierce, FL 34905; Tel: 772-465-1165; Fax: 772-466-1134; Website: www.ociassociates.com
2. Johnson, Levinson, Ragan, Davila, Inc., 1450 Centrepark Blvd., Suite 350, West Palm Beach, FL 33401; Tel: 561-689-2303; Fax: 561-689-2302; Website: www.jlrdinc.com.
3. TLC Engineering, 874 Dixon Blvd., Cocoa, FL 32922; Tel: 321-636-0274; Fax: 321- 639-8986; Website: www.tlc-eng.com.

1.6 COORDINATION

A. Commissioning Provider will be hired by Owner. Commissioning Provider shall direct and coordinate activities of commissioning team.

B. Commissioning team shall consist of Commissioning Provider, Owner, GC/CM, and associated subcontractors.

C. Scheduling: Commissioning Provider shall schedule commissioning activities of and shall coordinate schedule with GC/CM. Commissioning Provider shall generally provide not less than two weeks' notice to GC/CM of commissioning activities, except where retesting is required, or commissioning activities have been delayed by no fault of commissioning firm.

1.7 COMMISSIONING PROCESS

A. Commissioning Provider shall develop and coordinate execution of commissioning plan; observe and document installation, check-out, start-up, and equipment and system testing to establish that equipment and systems are functioning in accord with project requirements, and to assist in developing correct and complete documentation of construction effort.

B. Commissioning Provider shall not be responsible for design concept, design criteria, compliance with codes, design, construction scheduling, cost estimating, construction management, or construction supervision.

C. Commissioning Provider may assist design team with problem-solving, or GC/CM with correction of non-conformance items or deficiencies.

D. Commissioning Provider is not responsible for providing tools required to start, check-out and perform functional tests of equipment and systems, except for specified testing with supplemental portable data-loggers, which shall be supplied and installed by Commissioning Provider.

E. Work Required during Construction Phase:

1. Ensure compliance with construction documents, and achieve following objectives:
2. Review the engineer of records basis of design as well as the project design documents and make comments pertaining to the execution of commissioning.
3. Develop commissioning plan and distribute to GC/CM, Owner and Engineer.
4. Coordinate commissioning activities during construction with GC/CM and ensure that commissioning activities are included in master project schedule.
5. Review submittals applicable to systems being commissioned, including GC/CM proposed detailed start-up procedures, concurrent with Engineer's reviews and provide review comments to Engineer and Owner.
6. Commissioning provider's review shall be for compliance with commissioning needs, and to aid in development of functional testing procedures and only secondarily to review for compliance with equipment specifications. Design professional remains responsible for interpretation of compliance with contract requirements.
7. Request and review additional information as required to perform assigned commissioning tasks, including review of operations and maintenance materials, and GC/CM's start-up and check-out procedures.
8. Develop specific Functional Performance Test procedures and forms to document proper operation of equipment and system.
9. Submit proposed functional tests to Engineer for review and general conformance to requirements of contract documents and provide copy of proposed functional performance test procedures to GC/CM who shall review proposed tests for feasibility, safety, equipment, and warranty protection.
10. Required performance testing includes control system trending, stand-alone data logger monitoring, or manual logging of system operation to demonstrate proper operation. Functional Performance Test forms shall include following information:
    a. Date.
    b. Project name.

c. System and equipment or component name(s).

d. Equipment location and identification number.

e. Test identification number, and reference to pre-function checklist and start-up documentation identification numbers for each piece of equipment.

f. Participating parties.

g. Reference to specification describing specific sequence of operations or parameters being tested or verified.

h. Formulae used in calculations.

i. Required pre-test field measurements.

j. Instructions for setting up test.

k. Special cautions or alarm limits.

l. Specific step-by-step procedures to execute test, in clear, sequential, and repeatable format.

m. Acceptance criteria of proper performance with provisions for clearly indicating whether or not proper performance of each part of test was achieved.

n. Section for comments.

o. Signature and date block for Commissioning Provider and participating parties.

11. Review GC/CM start-up and pre-functional testing reports and provide on-site observation of start-up and pre-functional testing as specified herein.

12. Review proposed testing, adjusting, and balancing execution plan for completeness and requirements of commissioning process and provide comments to GC/CM, Engineer, and Owner.

13. Perform site visits, monthly until pre-functional testing of equipment and systems begins, and then weekly throughout Project, to review component and system installations. Concurrently, schedule and conduct commissioning planning and coordination meetings to review construction progress and to assist in resolving discrepancies or issues relating to commissioning process.

F. Acceptance Phase: demonstrate that performance of equipment and systems installed during construction phase meets requirements of construction documents. Notify Owner and Engineer of deficiencies in results or procedures. Commissioning activity shall achieve following objectives:

1. Coordinate, witness, and approve functional tests of equipment and systems performed by GC/CM. Review functional test reports and analyze trend logs, data logger reports, and other monitoring data to evaluate equipment and system performance.

2. Document performance of functional testing and provide comparison to required performance, as defined by project documents.

3. Coordinate retesting as necessary until satisfactory performance is demonstrated.

4. Maintain master deficiency and resolution log, separate testing record log, and provide written progress reports and test results with recommended corrective actions for observed deficiencies.

5. Compile and submit commissioning report to Owner and Engineer documenting results of the Start-Up, Pre-Functional Performance Testing, and Functional Performance Testing.

6. Review GC/CM’s proposed training of Owner’s operating personnel and provide comments to Engineer and Owner.

7. Coordinate and attend GC/CM provided training sessions. Verify approved training has been properly completed.

G. Warranty period: Assist Owner in identifying defects in installed equipment or system operation to accomplish following objectives:

1. Review equipment warranties to ensure that Owner's responsibilities are clearly defined.
2. Verify that warranty items have been corrected properly.
3. Coordinate and supervise required seasonal or deferred testing and deficiency corrections, as specified or required by commissioning plan.
4. Return to site, approximately 10 months into warranty period and review with Owner building operation and condition of outstanding issues related to original and seasonal commissioning.
5. Assist Owner in reviewing failure and repair records of equipment during warranty period and in evaluation of GC/CM's corrective actions. Identify areas that may come under warranty or under original construction contract.
6. Interview Owner and identify problems or concerns regarding operating building as originally intended and shall make suggestions for improvements.
7. Assist the Owner in developing reports, documents, and requests for services to remedy outstanding problems.

PART 2 – PRODUCTS

(NOT APPLICABLE)

PART 3 - EXECUTION

3.1 REPORTING

A. Provide final commissioning report to Owner with following reports:

1. Copies of periodic commissioning reports.
2. Copies of Pre-Functional Performance Test reports.
3. Copies of Functional Performance Test reports.
4. Copies of the Training Report.

3.2 SYSTEMS TO BE COMMISSIONED

A. As defined previously herein under item 1.1, F.

3.3 START-UP, PREFUNCTIONAL CHECKLISTS, AND INITIAL CHECK-OUT

A. GC/CM shall be responsible for initial check-out and pre-functional testing of installed equipment and systems.

B. Commissioning Provider shall monitor activities of parties responsible for executing required start-up, and pre-functional testing, as identified in commissioning plan.

C. Commissioning Provider shall review GC/CM furnished documentation of start-up, initial check-out, and pre-functional test procedures for equipment and systems to ensure that there is written documentation that each manufacturer-recommended procedure has been completed.

D. Observe pre-functional test procedures for each type and size equipment to ensure that approved procedures are being followed.

1. For lower-level components of equipment, (e.g., variable volume terminal units, sensors, controllers), observe sampling of pre-functional and start-up procedures.
2. In no case, shall number of units witnessed be less than 20% of total number of identical or very similar units.

3.4 FUNCTIONAL PERFORMANCE TESTING

A. Functional Performance Testing of equipment or systems shall be conducted only after pre-functional testing and start-up has been satisfactorily completed. Schedule functional tests with

GC/CM. Direct, witness, and document Functional Performance Testing of equipment and systems to be commissioned. GC/CM shall be responsible for execution of Functional Performance Tests.

B. Functional Performance Testing shall demonstrate that each item of equipment and each system is operating according to requirements of construction documents as defined by A/E. Each item of equipment and system undergoing Functional Performance Testing shall be operated through all modes of operation where there is required system response. Verify each action required in sequences of operation has been accomplished according to requirements, or A/E shall revise sequences as deemed appropriate.

C. Functional Performance Testing shall proceed from components to subsystems to systems. When proper performance of interacting, individual systems has been achieved, interface or coordinated responses between systems shall be tested.

D. Proper and accurate operation of control system shall be proven by functional testing and approved by Commissioning Provider before it may be used for testing, adjusting and balancing activities or to verify performance of other components or systems. If authorized by Commissioning Provider, portions of control system may be tested and approved before functional testing of the entire system is completed.

E. Air and water balancing shall be completed and corrected as necessary before Functional Performance Testing of air-related or water-related equipment or systems.

F. Test Methods:

1. Functional Performance Testing and verification shall be achieved by manual testing (direct manipulation of equipment and observation of its response and performance) or by monitoring performance using control system’s trend log capabilities.
2. Functional Performance Test procedures shall specify which methods shall be used for each test. Determine which method is most appropriate for tests that do not have method specified.
3. Commissioning Provider may substitute specified methods or require additional method to be executed, other than that specified, if required to demonstrate proper operation of equipment or system being tested.
4. Develop Functional Performance Testing plans that define allowable sampling procedures and that specify procedures to be followed in case of observed discrepancies or failures in sample chosen for functional testing.
5. AHU operation (leaving air temperature, VFD speed) shall be trend logged with VAV box and air valve flow rates, as well as space temperatures to demonstrate modulation of system components with changing loads, as well as occupied/non-occupied status and control strategies such as optimum static pressure reset and temperature set-up/set-back.
6. Sampling: multiple identical pieces of non-life-safety or otherwise non-critical equipment may be functionally tested using sampling strategy, as defined in functional test procedures.
    a. Significant application differences and significant sequence of operation differences in otherwise identical equipment invalidates their common identity.
    b. Small size or capacity difference, alone, does not constitute difference.
    c. The following equipment may be sample tested: reheat coils, terminal boxes, occupancy sensors, and lighting controls.
7. If 10% or 3 or more identical pieces of equipment (size alone does not constitute a difference) fail to perform to requirements of project documents (mechanically or substantively) due to manufacturing defects or application error not allowing it to meet performance specifications, identical units may be considered unacceptable by

Commissioning Provider. In such case, GC/CM shall provide Commissioning Provider with the following:

a. Within 1 week of notification from Commissioning Provider, GC/CM or manufacturer's representative shall examine other identical units making record of findings. Findings shall be provided to Commissioning Provider within 2 weeks of original notice.

b. Within 2 weeks of original notification, GC/CM shall provide signed and dated, written explanation of problem, cause of failures, and proposed solution, including full equipment submittals for corrective or replacement equipment, if appropriate. Proposed solutions shall meet requirements of original installation.

c. Commissioning Provider shall evaluate proposed solution and submit recommendation of approval or disapproval to Owner and Engineer.

d. When approved, 2 examples of proposed solution shall be installed by GC/CM and Commissioning Provider shall schedule and conduct functional testing of proposed solution. Upon completion of functional testing of proposed solution, Commissioning Provider shall recommend acceptance or disapproval of proposed solution to Owner.

e. Upon acceptance of proposed solution by Owner, GC/CM shall replace or repair identical items and extend warranty accordingly, if original equipment warranty had begun. Replacement/repair work shall proceed with reasonable speed beginning within 2 weeks of approval of proposed solution.

8. Ensure that each Functional Performance Test is performed under conditions that simulate actual operating conditions as closely as is practically possible.

9. Simulation of operating conditions (not by overwritten value) may be allowed, at Commissioning Provider's discretion. Simulation of conditions shall be accomplished by subjecting the equipment to actual operating conditions by artificial means whenever possible.

10. Where actually achieving simulated operating condition is impractical, as determined by Commissioning Provider or as identified in Functional Performance Test procedure, use of signal generators to create simulated signal may be used to test and calibrate transducers and DDC constants instead of using sensor to act as signal generator via simulated conditions or overwritten values. Signal generators or simulators shall be provided by GC/CM.

11. Overwriting sensor values to simulate conditions, such as overwriting outside air temperature reading in control system to be different than it really is, may be allowed if approved by Commissioning Provider. Simulation of operating conditions is preferable.

12. Altering setpoints: rather than overwriting sensor values, and when simulating conditions is difficult, altering setpoints shall be used to test sequences.

13. Indirect indicators: relying on indirect indicators for responses or performance may be allowed only after the Commissioning Provider has visually and directly verified that indirect readings represent actual conditions and responses over range of test parameters.

3.5 RETESTING OF EQUIPMENT AND/OR SYSTEMS

A. Prior to retesting of functional performance tests found to be deficient, submit data indicating that deficient items have been completed and corrected to Commissioning Provider.

B. After review of submitted data, if corrective measures are acceptable, Commissioning Provider shall schedule, and conduct recheck.

C. If during retesting it becomes apparent that deficient items have not been completed and corrected as indicated in data provided by GC/CM, retesting shall be stopped. Costs for commissioning teams to further supervise retesting of Functional Performance Test shall be the responsibility of GC/CM.

3.6 DOCUMENTATION, NONCONFORMANCE, AND APPROVAL OF TESTS:

A. Documentation: Witness and document results of functional tests using specific procedural forms developed for that purpose. Deficiencies or nonconformance issues shall be noted and reported with test results. Include completed test forms in final commissioning report.

B. As Functional Performance Testing progresses and deficiencies are identified, discuss issues, and attempt to resolve discrepancies with GC/CM.

C. Approval: Note each satisfactorily demonstrated function on functional test form. Formal approval of functional tests shall be made after review of test reports by Commissioning Provider and Owner. Recommend acceptance of each test to the Owner using standard form. Owner shall give final approval on each test using same form, providing signed copy to Commissioning Provider and GC/CM.

3.7 DEFERRED TESTING

A. Deferred testing: if required pre-functional or functional test cannot be completed as scheduled, execution of checklists and functional testing may be delayed upon approval of Commissioning Provider and Owner. Deferred tests shall be conducted in same manner as seasonal tests as soon as possible.

B. Schedule and coordinate any required seasonal testing, tests delayed until weather or other conditions are suitable for demonstration of equipment or system’s performance. Seasonal testing shall be executed, documented, and deficiencies corrected as specified herein for functional testing. Adjustments or corrections to operations and maintenance manuals and record documents due to test results of shall be made before seasonal testing process is considered complete. Schedule deferred testing with GC/CM and Owner.

3.8 OPERATION AND MAINTENANCE MANUALS

A. Prior to beginning specified training programs, review draft operations and maintenance manuals, equipment documentation, and as-installed drawings for systems that were commissioned and verify compliance with documents. Communicate deficiencies in documents to Owner and Contractor. When identified deficiencies have been corrected, recommend approval and acceptance of operations and maintenance manuals to Owner. Review equipment warranties and verify that requirements needed to keep warranty valid are clearly identified.

B. Ensure that Owner's Project Requirements, basis of design, are included in the first section of operations and maintenance manuals. Narrative sections shall be updated by responsible parties to record status.

END OF SECTION

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SECTION 23 09 00 - HVAC INSTRUMENTATION AND CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

B. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Provide all required devices to tie into the existing EMS system to integrate into the system.

B. Complete system of control and interlock wiring including wiring specified in Section 23 05 18, “Control Wiring” and Section 23 09 93, “Sequence of Operation”.

C. Interface with Product Integrated Controls specified in other sections of the specifications.

D. This section also includes Web Based Open Protocol DDC building network controllers and Equipment controllers that are open protocol utilizing BACnet protocol for the purpose of controlling HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory wired controls, lighting in new and existing facilities.

E. Access to the controls shall be through an owner provided IP address with use of a user ID and password. Contractor to provide a web server as part of the contract.

1.3 QUALITY ASSURANCE

A. The installation of the building control system devices shall be by the manufacturer of the controls or his local authorized agent who has a minimum of 5 years of representation.

B. All electrical components 25 V and above shall be U.L. listed or labeled.

C. All equipment or piping used in the conditioned air stream, spaces or return air plenums shall comply with NFPA 90A Flame/Smoke/Fuel contribution rating of 25/50/0 and all applicable local building codes or requirements.

D. All wiring shall conform to the National Electrical Code (NEC).

E. All smoke dampers shall be rated in accordance with UL 555S.

1.4 DEFINITIONS

A. Control Wiring: All wiring, 120 VAC or low voltage other than power wiring, required for the proper operation of the mechanical system.

B. Power Wiring: All line voltage wiring to the mechanical equipment. Note: Where line voltage serves a control circuit such as power to a transformer, power to a DDC control panel, power for a line voltage thermostat, or damper this shall be considered control wiring.

1.5 SUBMITTALS

A. Submit in accordance with Division 1 Requirements.

B. Provide complete catalog data and installation instructions for each control component. Include damper and valve sizing details.

C. Control system submittal shall contain the following graphics and documentation for each system being controlled:

1. Communications bus schematic showing all panel locations and hardware requirements.
2. Schematic wiring diagrams in ladder form for each system including power source.
3. Schematic diagram with detail of all hardware, components used, location of instruments, bulbs, dampers, valves, and other components. The chart shall include control chart including control symbols, quantity, manufacturer's part number, tech sheet reference (include in submittal) and description of part.

4. Each DDC field panel shall be detailed in the submittal to identify termination boards within each panel and terminal of their respective field points. Each termination point shall define the point name and point description by each terminal with the field panel. Point names and descriptors shall be consistent throughout the submittal on the schematics, wiring diagrams, equipment list, etc.
5. Submit the system architecture or configuration complete with all processors, terminals, other peripheral devices, modems, etc., with interconnecting diagrams.
6. A report shall be included in the submittal to include every point in the entire system. The report shall include the programmed data for each point:
    a. Point Name
    b. Point Type (analog, digital, etc.)
    c. Point Descriptor
    d. Physical Address (enclosed legend)
    e. Alarm (yes or no)
    f. Print Alarm (yes or no)
    g. High Limit
    h. Low Limit
    i. Totalized (yes or no)
    j. Hours or Minutes Totalized
    k. Engineering Unit of Point
7. A flow chart form of sequence of operation in abbreviated English language.
8. English language sequence of operation defining flow chart with control company programmed inputs to reflect English language sequence. Each sequence task shall be followed by the control company coded program. One list of coded programmed inputs at the end of each sequence of operation shall be acceptable.

D. For each Direct Digital Control (DDC) panel provide:
1. Point List identifying each input and output by point name, point type, hardware description, wiring terminations, mounting arrangements and software features.
2. Complete English language description of all software.
3. Flow diagram and complete details program.

1.6 CONTROL SYSTEM GENERAL REQUIREMENTS

A. The control system shall be of the electronic microprocessor type employing Direct Digital Control (DDC) Open Protocol technology (BACnet) technology for all control sequences unless specifically stated otherwise in the Sequence of Operation portion of this specification.

B. All DDC controllers shall be connected via a communications bus to an operator’s panel. The operator’s panel may be located on the face of one of the DDC controllers, or at an alternate location as approved by the Engineers. In addition, a portable operator’s panel may be connected to the system at any DDC controller location.

C. All DDC controllers shall be connected to a global information handler, which shall send and receive information of the existing global nature throughout the system.

D. Provisions shall be made to allow additional DDC controllers to be added at any point on the communications bus for future expansion.

E. Field Installed Devices (FID) shall be capable of stand-alone operation, as well as interfacing with the networked Building Control System. These controllers shall be based on BACnet Protocols. No other protocols for this section will be acceptable.

F. Valve and damper operators shall be of the electronic type.

G. The existing Building Control System is made up of HVAC equipment with factory installed microprocessor-based Product Integrated Controls (PIC), distributed microprocessor-based Field Installed Devices (FID), input/output modules and necessary software set up for expansion under the original.

H. The Product Integrated Controls (PIC) shall be factory installed controls capable of stand-alone operation. The controller shall be specifically designed to operate and monitor the functions of the HVAC equipment on which it is installed. The PIC shall be capable of interfacing onto the network.

1.7 INTENT OF DRAWINGS AND SPECIFICATIONS

A. The implied and stated intent of the drawings and specifications is to establish minimum acceptable quality standards for materials, equipment, and workmanship and to provide a tie into the existing building control system. The ultimate goal of the MCSD for this campus and project is to have a fully integrated BACnet EMS system.

B. The drawings are diagrammatic intending to show a workable general arrangement and location of system components and are not necessarily complete or rigid in all details.

C. No deviation in the specified sequence of operation, as specified on drawings, will be allowed without written approval from the Engineer.

1.8 OPERATION AND MAINTENANCE MANUALS AND INSTRUCTIONS FOR OWNER

A. Operation and maintenance manuals shall be provided as outlined in Division 1 Requirements. The manuals shall include all data which was a part of the original submittal with as- built wiring diagrams, parts lists and operating and maintenance instruction manuals.

B. Refer to training hours table and scope in section 23 05 00 for job owner training conducted by a technician or technicians fully qualified to conduct such training shall be provided. Instruction or Training shall include, but not be limited to:

1. Instructions in the manufacturers recommended maintenance and operating procedures.
2. Instructions in the detailed sequence of operation of the mechanical equipment controls.
3. Instructions in reading and using the control wiring diagrams.
4. Instructions in control setpoint adjustment as relating to each specific system provided under this section.
5. Performance testing as described in Part 3.

1.9 COOPERATION WITH OTHER CONTRACTORS

A. The Building Control Sub-Contractor shall coordinate with other trades to assure a complete and operational Building Control System.

B. This contractor shall furnish to the air balance contractor (Section 23 05 93) a notebook PC computer for terminal box set-up. At the completion of the balancing, the terminal shall be turned over to the owner.

1.10 MATERIALS, STORAGE AND HANDLING

A. All components shipped to the job-site and stored on-site shall be stored in a clean, dry storage location.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS/REPRESENTATIVES

A. Siemens

B. Johnson Controls

C. Trane

D. Automated Logic

E. Engineer-approved Equal

2.2 EQUIPMENT

A. Direct Digital Control (DDC) Controllers:

1. Direct Digital Control (DDC) Controllers shall be field programmable microprocessor based, electronic controllers incorporating direct digital control technology. The DDC controllers shall be capable of performing their assigned control and energy management functions as standalone units or as part of a comprehensive Building Management System. The controllers shall be capable of performing energy management functions including, but not limited to supply air and water reset, duty cycling, morning cool-down and warm-up, solar compensation, unoccupied setback, and real-time scheduling.
2. The controllers shall have built-in, non-volatile, real-time calendar clocks capable of generating real and elapsed time signals in years, months, days of the week, hours, minutes, and seconds, as well as elapsed time in days, hours, minutes, and seconds. The controller shall be provided with a minimum of 72 hour back-up capability protect against loss of time in the calendar clock and the programmed software and provide surge protection on the head end terminal.
3. The controllers shall be capable of interfacing with a standard twisted pair communication channel for local operation and shall be protected with software security code keys to prevent unauthorized access. Where practical, controllers shall be fully distributed and dedicated to an individual piece of equipment or system. When input/output requirements exceed the capacity of a controller, additional controllers shall be connected serially in a daisy chain configuration to allow for the use of a single RS485 interface channel for multiple controllers. Global level controllers shall allow full Internet Protocol (IP) communications through a static IP connection through a 10/100 megabit per second Ethernet protocol.
4. The controllers shall be programmed for the sequences of operation defined hereinafter. The execution of these sequences shall be fully automatic and without operator intervention. The controllers shall sense all of their inputs, test for multiple input programmed conditions and execute appropriate action on valves, dampers, pumps, fans and other equipment. The programmed conditions may include any combination of inputs, outputs, time and the mathematical operations (addition, subtraction, greater than, less than, square root, or absolute value). Program changes shall be entered into the controllers without interruption of the system operation.
5. The controllers shall be completely field programmable from a standard portable programming unit, a CRT terminal or from a remote location through a telephone modem. The program logic shall allow changes without interruption of the system operation.
6. The controllers shall be programmed to examine their inputs for emergency conditions and to automatically initiating the actuation of the appropriate alarm mode.
7. The operator, through a terminal, shall be capable of overriding the programmed control sequence to manually operate the outputs for system checkout. All sequences of operation shall be demonstrated through this simulation technique. The controllers shall be stepped through their sequence to verify system operation. During the maintenance routine, the controllers shall be capable of selectively disabling inputs and outputs without affecting the operations of the remaining inputs and outputs. The controller’s status shall be accessible through the ASCII channel. Upon appropriate commands, the controller shall read out time, analog input values, output status, program line number being processed, disabled inputs, disabled outputs, and sequencing program logic. Through the ASCII channel, the controllers shall be capable of printing a data history log for maintenance and troubleshooting of the system.

8. The controllers shall have a minimum of four levels of access available for terminal operation of the unit. The number of functions allowed an operator shall be determined by the level of password that is correctly entered into the controller.
9. The executive operating system provided with the controllers shall provide for all the functions described herein. The executive system shall provide English error messages to the user when any command or date is entered that cannot be understood by the microprocessor. An editing system shall also be provided for program entry. A program and variable trace routine shall also be provided to allow for easier program testing and debugging.
10. Digital Controllers used to control terminal equipment, such as variable volume boxes, shall be designed as individual control units. All variables shall be capable of being viewed and changed from the operator's panel, or the portable operator's console.
11. Digital Controllers used to control variable air volume (VAV) boxes shall include:
    a. Pressure independent air volume controller capable of controlling air volume within 5% of design air volume from minimum to maximum flow and at all points in between regardless of changes in system static pressure. Air volume maximum and minimum to be factory set and field re-adjustable. Controller shall be capable of 3 set positions: Off, Minimum and Maximum with VAV control from the min. to max. position. Minimum air volume shall be accurately controlled as low as 100 FPM based on inlet duct size. Maximum and minimum air volumes as scheduled on the drawings. If special multi-point velocity sensor is required to meet the specification, this supplier to furnish and coordinate installation with terminal supplier.
    b. 24 VAC damper actuators. NC control operation as specified.
    c. Digital output for fan control.
    d. Digital outputs for each step of electric heat control.
    e. Temperature sensor.
    f. A factory calibrated damper assembly and multi-point velocity sensor is specified to be provided with VAV terminals under Section 23 36 00, "Air Terminal Units". Provide 24V power source and wiring to terminal controller on VAV units which do not have a fan under this division, and in addition, a 24V, 40VA control transformer will be supplied on fan powered units by the terminal manufacturer. This supplier shall coordinate all requirements with the terminal supplier.

B. Input-Output Devices:
1. Temperature Sensors:
    a. Temperature sensors shall be provided for space, duct, fluid, and outside air sensing which are compatible with the digital controllers. All temperature sensors shall be accurate to .36-degrees F over a range of -30 to 220-degrees F and shall have a demonstrated stability of .04-degrees F over a 10 year period.
    b. Temperature sensors shall be 10K resistor style.
    c. All sensors in water lines to be installed in wells. If a permanent thermometer is not located at sensing point, a second well will be installed adjacent for temperature verification purposes.
    d. All sensors for cooling or heating coil leaving air temperatures shall be serpentine type across entire coil surface area. Sensing tube type is not acceptable.
    e. Room temperature sensors in public spaces (Auditoriums and Gymnasiums) shall have concealed setpoint adjustment with blank covers.
    f. Room temperature sensors in private offices and classrooms shall have user accessible setpoint adjustment with setpoint indication and space temperature

indication with adjustable minimum and maximum setpoints capability with digital read outs.

2. Humidity Sensors:
   a. Electronic Humidity Transmitters: Electronic humidity transmitters shall produce a linear 4-20 ma signal over a range of 0 to 100% RH. Accuracy shall be 2% of full scale.
   b. Single point calibration.
   c. Shall be either VAISALA HMD-60U for duct applications and VAISALA HMW- 60U for wall mounted applications or Veris.
   d. Room Humidity sensors shall be integral to the room temperature sensor so that there is only one sensor per room.
3. Pressure Sensors:
   a. Electronic static and differential pressure transmitters shall be stainless steel diaphragm type, with a variable capacitance electrode to produce a linear signal over the appropriate input range. Input ranges shall be available from 0.1 in. H_2O to 7.5 in. H_2O and transmitters shall be selected for 150% of the design pressure. Both zero and span shall be field adjustable. Accuracy shall be □1% of full scale over the selected range, wherever differential pressure transmitters are subject to damage by disconnecting pressure lines, provide three valve manifolds for disconnection and testing. Based on Setra Model C239.
4. Valves and Operators:
   a. Isolation Type Valves:
      i. 2 inches and smaller: Ball style, sized for minimum pressure drop.
      ii. 2-1/2 inches and larger: Butterfly style, sized for minimum pressure drop.
   b. Control Valves:
      i. Valves shall be provided with equal percentage modulating plugs; renewable composition disk especially compounded for hot or cold water service to assure tight seating. Three-way valves shall be furnished with modulating type plug assemblies and shall have one seat machined integral with the body and the other three-way valve end.
      ii. Valves shall be sized as indicated or as required to guarantee sufficient size to meet the heating or cooling requirements with specified pressure drops. Water valves shall be sized for 2 psig minimum and 5 psig maximum pressure drop. Valves 2 inches and smaller shall be screwed and valves 2-1/2 inches and larger shall be flanged.
   c. Valve operators:
      i. Shall be gear driven electronic. Operators shall be of sufficient size to ensure smooth positive operation and tight shut-off against system pressure.
      ii. Electronic operators shall be of the positive gear driven type using a brushless DC motor with built-in mechanical stops and electronic current limiting circuit to prevent burn-out. The drive motor shall be microprocessor controlled and capable of accepting a 4-20 mA, 0-10 V DC, 0-20 V Dc phase cut, on-off, or floating tri-state control signal as required. Based on Belimo Air controls (USA), Inc.
      iii. Preheat coil valves and valves on the primary and secondary heating water circuits shall have spring returns. The water valves shall be designed to go to the open position on power or other failure.

iv. The source of power for valve operation, electronic shall be the responsibility of the BCS Contractor.

5. Butterfly Valves and Operators:
   a. Isolation valves and control valves 4 inches and over may be butterfly type.
   b. Valves to have 416 stainless steel stem, full lug, cast iron or ductile iron body to permit removal of downstream piping, long neck body extended to allow for a minimum of 2 inches insulation, aluminum bronze or stainless-steel disc, bubble tight EPDM seat, infinite position throttling, Class 150, 20-degrees F to 220-degrees F range.
   c. Where three way valves are shown, factory furnished T-assemblies with mounted valves and cross linkage may be used.
   d. Valves to have gear driven electronic operators. Operators to be of sufficient size to ensure smooth, positive operation and tight shut-off against system pressure. Preheat coil valves and valves on the primary and secondary heating water circuits shall have spring returns. The water valves shall be designed to go to the open position on power or other failure.
      i. Shall be gear driven electronic. Operators shall be of sufficient size to ensure smooth positive operation and tight shut-off against system pressure.
      ii. Electronic operators shall be of the positive gear driven type using a brushless DC motor with built-in mechanical stops and electronic current limiting circuit to prevent burn-out. The drive motor shall be microprocessor controlled and capable of accepting a 4-20 mA, 0-10 V DC, 0-20 V Dc phase cut, on-off, or floating tri-state control signal as required. Based on Belimo Air controls (USA), Inc.
      iii. Preheat coil valves and valves on the primary and secondary heating water circuits shall have spring returns. The water valves shall be designed to go to the open position on power or other failure.
      iv. The source of power for valve operation, electronic shall be the responsibility of the BCS Contractor.
   e. The source of power for valve operation, electronic shall be the responsibility of the BCS Contractor.
   f. Based on Keystone Fig. AR2.
6. Dampers and Operators:
   a. Provide outdoor air control dampers with the following features:
   b. Frame: aluminum channel with corner braces.
   c. Blade: 6 inches maximum width, opposed blade, aluminum airfoil.
   d. Axles: 1/2 inch hex axle stainless steel shaft, secured tight to the blade; non-stick, non- corrosive, molded synthetic bearings.
   e. Control Shaft: 6" x 1/2” diameter, galvanized steel control shaft with outboard support bearing.
   f. Actuator Bracket: Concealed in damper frame, galvanized steel.
   g. Seals: edge and jam seals.
   h. Leakage Rates: Maximum leakage rates shall not exceed the following values when tested at 1 inch WG pressure differential per AMCA Publication 500.

Damper Width	Leakage Rate
12 inches	65 CFM/SF
24 inches	50 CFM/SF
36 inches	40 CFM/SF
48 inches	40 CFM/SF

i. Performance specifications are based on Ruskin CD50. Other products satisfying the specifications are acceptable.

j. Electronic operators shall be of the positive gear driven type using a brushless DC motor with built-in mechanical stops and electronic current limiting circuit to prevent burn-out. The drive motor shall be microprocessor controlled and capable of accepting a 4-20 mA, 0-10 V DC, 0-20 V DC phase cut, on-off, or floating tri-state control signal as required. Based on Belimo Air Controls (USA), Inc., Invensys DuraDrive and Tamco.

k. Actuators for outdoor air and exhaust air dampers shall have spring return, and the dampers shall be designed to go to the closed position on power or other failure.

7. Smoke Detectors:

   a. Smoke detectors (SD) will be furnished and installed by Division 26 - Electrical and Division 23 – Mechanical. (Refer to Specification Section 23 33 00). Detectors will be required in all air handling systems greater than 2000 CFM. Detectors will be required in both supply and return ducts of air handling units or on multi-story buildings in the return at each floor. The detectors shall be wired to shut-down the fans and indicate status to the DDC controls. In the case of an engineered smoke control system, they shall be wired to control as specified and shall be interlocked with the fire alarm system.

8. High limit thermostats (FS) shall be provided for each exhaust fan and shall be of the manual reset type. Thermostats shall be UL listed and shall be wired to shut down their respective fans should the temperature in the duct rise above 125-degrees F (adj.).

9. Low limit thermostats (FR) shall be provided as indicated and shall be wired to shut down their respective unit should the temperature at any point on its sensing element fall below 35-degrees F (adj.). Thermostats shall require manual reset. Provide 1 foot of sensing element for each 2 sq. feet. of duct cross section.

10. Panels:

    a. All relays and similar devices shall be mounted within Control Panels. Quantity and location of control panels shall be dictated by the controls contractor’s system architecture.

    b. Control panels shall be dust tight and furnished with hinged locking doors. Provide an engraved nameplate on the face of the panel clearly describing its function. All devices located within the panel shall be clearly labeled. All wiring within the panel shall be in accordance with NEMA, UL standard, NEC and local codes. Details and proposed mounting location of each panel shall be submitted prior to construction.

    c. All panels shall be factory prewired and pre-piped to terminal strips prior to arrival at job site. The wiring shall be installed orderly and easily identifiable.

    d. Provide wiring diagram mounted inside door with plastic protective covering.

11. Relays:

    a. All relays shall be plugged in, interchangeable, mounted on a circuit board and wired to numbered terminal strips.

    b. Start/stop relay modules shall provide either momentary or maintained switching action as appropriate for the motor being started.

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12. Differential Pressure Switches: Binary differential pressure sensors shall be used to indicate pump and fan operation and for indicating high pressure drop across filters. These sensors shall be of the diaphragm type and shall be adjustable and furnished in ranges compatible with their service.
13. Current Sensing Relays:
    a. Solid state switch which operates when current level sensed by internal current transformer exceeds the threshold value set by the adjusting device. Internal circuits totally powered by induction from line being monitored.
    b. Current range and switching characteristics as required for intended duty.
14. Line Voltage Electric Thermostats:
    a. Where mechanical equipment such as certain exhaust fans or unit heaters are indicated to be controlled directly from a space thermostat, provide a thermostat of either the heating or cooling type depending upon the application.
    b. All line voltage thermostats shall be rated to carry 125% of the load of the controlled device.
15. Thermostat/Temperature Sensor Guard:
    a. Wire guard with steel base.
    b. Cast aluminum guard with steel base.
    c. Clear plastic guard with solid base and tumbler type key lock.
    d. Contractor to verify the location of these guards with engineer and Owner’s representative.
16. Air Flow Measuring Station: Duct and plenum mounted airflow measurement devices. The following is the only acceptable manufacturer:
    a. Tek-air’s Vortek VT-5000
    b. Alternatives requesting acceptance as “equals” less than 60 days prior to bid date or products submitted in non-conformance with the requirements of this specification will not be considered.
    c. For any product to be considered for substitution a written section-by-section detailed exceptions/compliance document shall be submitted to the Engineer before any approval will be considered.
    d. Any product offered as an equal shall make a working demo available for a side by side evaluation in the specifying engineer’s office.
    e. The working demo must be able to demonstrate airflow measurement throughout the entire specified range (50 - 5000 FPM), repeatability, response time and specification compliance. Providing a working demo in and of itself does not constitute its approval.
    f. Provide airflow/temperature measurement devices (ATMD) where indicated on the plans or as recommended by an authorized representative. Fan inlet measurement devices shall not be used unless specifically indicated on the plans.
    g. Each ATMD shall consist of one or more sensor probes and a single, remotely mounted, microprocessor-based transmitter capable of independently processing up to 16 independently wired sensor assemblies.
    h. Each sensor node shall contain two individually wired, hermetically sealed bead-in-glass thermistors.
    i. Thermistors shall be mounted in the sensor node using a marine-grade, waterproof epoxy. Thermistor leads shall be protected and not exposed to the environment.

Thermistor leads shall not be fastened to the thermistor semiconductor substrate by weld or solder connections.

i. The airflow rate of each sensor assembly shall be equally weighted and averaged by the transmitter prior to output. All integrated circuitry shall be temperature rated as 'industrial-grade'. Submissions containing 'commercial-grade' integrated circuitry are not acceptable.

ii. The temperature of each sensor assembly shall be velocity weighted and averaged by the transmitter prior to output.

iii. Each transmitter shall have a 16-character alpha-numeric display capable of displaying airflow, temperature, system status, configuration settings and diagnostics.

iv. Devices using chip-in-glass or diode-case chip thermistors are not acceptable.

v. Devices using less than two thermistors in each sensor assembly are not acceptable.

vi. Devices having electronic circuitry mounted in or at the sensor probe are not acceptable.

vii. Pitot tubes and arrays are not acceptable.

viii. Vortex shedding devices are not acceptable.

ix. Duct and Plenum Probes

a) Probes shall be constructed of extruded, gold anodized, 6063 aluminum tubes or optionally of Type 316 stainless steel tubes. All internal wires within the tube shall be Kynar coated. PVC insulated conductors are not acceptable.

b) The number of individual sensor nodes provided for each location shall be as follows:

Duct or Plenum Area (ft^2)	Total # Nodes / Location	Duct or Plenum Area (m^2)
<= 1	1 or 2	<= 0.093
>1 to <2	4	>0.093 to < 0.372
2 to < 4	6	0.372 to < 0.743
4 to < 8	8	0.743 to < 1.115
8 to <16	12	1.115 to < 1.486
>=16	16	>= 1.486

c) Sensor probe design shall be capable of providing up to 8 sensor nodes per probe.

d) The minimum operating airflow range shall be 0 to 5,000 FPM (25.4 m/s) unless otherwise indicated on the plans.

e) Each ducted sensor probe shall have an integral, U.L. Listed, plenum rated cable. Cable jackets and conductor insulation shall be FEP, Teflon-FEP or Neoflon-FEP. Cables shall include a terminal plug for connection to the remotely mounted transmitter. All terminal plug interconnecting pins shall be gold plated. PVC jacketed cables or PVC insulated conductors are not acceptable with ducted sensor probes.

17. Carbon Dioxide Monitor - Controller:
    a. CO2 sensing cell shall consist of a nondispersive infrared carbon dioxide gas cell that uses a pulse source and has no free air optical path. Output shall be linearized 4-20 mA for use with 24 VDC input. The unit shall be specifically designed for a wall application. Unit shall have span adjustment. The unit shall have no moving parts.
    b. Minimum Requirements:
        i. Range: 0-2,000 ppm
        ii. Accuracy: 3% of full scale
        iii. Repeatability: 1% of full scale
        iv. Zero Drift at Constant Temperatures: 100 ppm per 24 hours (random not cumulative)
        v. Max. allowable Drift in 1 year: 20 ppm
    c. Unit shall not require calibration for a period of 1 year or more.
    d. Unit shall have a 5 year warranty.
    e. Approved Manufactures:
        i. System Integrator’s brand-named product.
        ii. Valtronics
        iii. Telaire
        iv. Veris
18. Indoor Air Quality (IAQ) Sensor and Controller:
    a. Sensor to be located in return air duct. Sensor to supply a frequency modulated output signal superimposed on the DC supply as the contamination level in the air changes.
    b. The signal to be processed in the controller and compared to the setpoint. An increasing contamination concentration will cause the sensor to respond with an increasing output which will result in a proportional output from the controller.
    c. Sensor to carbon monoxide, carbon dioxide, formaldehyde and hydrocarbons which make up common indoor air pollution. The sensor shall respond to carbon dioxide and be capable of controlling to a limit as low as 500 PPM.
19. Photoelectric Sensor: Reflex type units containing the source and detector in the same enclosure using a remote reflector. An infrared light beam shall be emitted with a range of approximately 30 feet. Sensors shall be similar to Redington series 97 and 98. Installation may require recessing into mounting surface - coordinate with Architect and receive the Architect's approval prior to mounting sensors or reflector.
20. Control Air Tubing:
    a. Copper hard drawn or annealed.
    b. Fittings: Copper or brass, sweat or flare compression type.
    c. Non-metallic FR Polytubing. Tubing shall be suitable for use in return air plenums.
21. Programmable Lighting Panels:
    a. Programmable lighting panels shall contain up to 42 individual circuits as required. Each circuit shall contain a properly sized breaker and lighting contactor initiator. Lighting contactor initiator shall receive a signal from the Building Automation System to provide individual control for each lighting circuit.

b. Refer to the electrical drawings and schedules for additional information and requirements.

c. Programmable lighting panels are to be furnished by this contractor. Installations and power wiring are by Division 26.

22. Smoke dampers shall be as specified in Section 23 33 00, “Air Duct Accessories”.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. All system components and appurtenances shall be installed in accordance with the manufacturer's instructions and requirements. All necessary interconnections, services and adjustments required for a complete tie-in to the existing operable system shall be provided by this contractor.

B. The contractor shall review all contract drawings and specifications, including addenda and referenced material and shall visit the job site, if applicable in order to become informed prior to bidding as to existing conditions and limitations of the project. The contractor shall bring exceptions and inconsistencies in drawings, specifications, addenda, referenced material, other contract documents and site conditions to the attention of the engineer.

C. The location of material, equipment and devices shown on the drawings are approximate and are subject to such revisions as may be necessary or desirable at the time that the work is being installed. The contractor shall install the work in relation to existing conditions. Should project conditions require rearrangement, or if equipment or accessories can be installed to better advantage in a different manner, prepare and submit five copies of shop drawings indicating the proposed rearrangement for the Engineer's review.

D. Chilled Water Systems: Furnish a test well for installation under Section 23 05 19, adjacent to each temperature sensor where a fixed thermometer is not provided.

E. Control Wiring:

1. All wiring incidental to the building control system, including electrical interlocks shall be included in this section and provided as part of the building control system.

2. All control wiring shall be run in conduit where required by code or where the possibility of harm or permanent damage exists. In addition, all wiring installed below 8 feet or below suspended ceilings shall be installed in conduit.

3. Any wiring not installed in conduit shall be multi-conductor cable, with individual wires color codes for ease of installation and troubleshooting. All wiring installed above a plenum ceiling shall be Teflon coated and rated for plenum service.

4. All wiring shall be concealed wherever possible and installed in a neat and workmanlike manner. All wiring and conduit shall be run parallel or perpendicular to the building structure. All cables shall be supported at frequent intervals and attached to supports by the use of nylon tie-wraps.

5. Control wiring shall conform to the requirements of Section 23 05 18, “Control Wiring” and all applicable section of Division 26.

F. Terminal Controls: Unless provided by the terminal manufacturer, Direct Digital Controllers controlling VAV boxes, damper operators and velocity transmitters shall be shipped to the VAV box manufacturer for factory installation. Provide the box manufacturer with complete wiring and piping diagrams and detailed installation instructions. Box manufacturer shall furnish and install 24 volt transformer.

G. System Start-up and Check-out:

1. The manufacturer shall provide a control technician for the start-up, check-out of all input and outputs, implement and check the software function and submit report on check-out of each system.

2. Demonstrate to the Owner that all functions are operating as per final approved sequences.
3. The manufacturer shall provide a control technician for the training of the Owner's operators as detailed in Division 1 Requirements.

H. System Acceptance & Trend Log Submittal:

1. After completion of the installation, check-out and control loop tuning, and trend logs shall be submitted, as listed below, to demonstrate the satisfactory performance of the system and to serve as a data base for the owner's future use.
2. The trend logs shall be organized in spread sheet format and presented in both tabular and graphical form. A disc or tape copy of each final accepted trend log set shall also be provided. Trend logs shall be as follows:
3. Control Stability Trend Logs:
    a. Each digital or analog output to valves, dampers, adjustable frequency drives and other control devices shall be included.
    b. Scan time shall be at five second intervals for a duration of ten minutes.
    c. Start of the sets shall be immediately after change from one mode to another, i.e., unoccupied to occupied, no economizer to economizer, off to on, etc. Only one log will be required for each output as long as it addresses all controlled elements.
    d. Where control of a piece of equipment is by factory furnished packaged controls, then the controlled temperature which is monitored shall be included. For instance, where a chiller is controlled by its own control system and control is from leaving chilled water temperature, then leaving chilled water temperature shall be included in the log set.

3.2 EQUIPMENT ADDITIONAL REQUIREMENTS

A. Smoke Detectors:

1. Smoke detectors will be furnished and installed under Division 26. Power wiring, alarm circuit and supervisory circuit will be provided under Division 26. Control wiring to auxiliary contacts required to shut-down fans (hard wired) and alarm BCS shall be provided by this Section.
2. All detectors shall function properly; equipment shall shut down and dampers must be tested for operation prior to building occupancy with design air flow to ensure operation under normal conditions. Provide a letter to the Owners Representative certifying that these tests have been conducted.
3. When an engineered smoke control system is specified, the smoke detectors shall function as specified.

B. Air Flow Measuring Stations:

1. Install air flow measuring stations on the inlet bells of the fan as specified. 120V AC power wiring and control wiring will be provided under this section.
2. For airflow measuring stations that cannot be mounted on the inlet bells of the fan, furnish air flow measuring stations for installation under Section 23 33 00 - Air Duct Accessories wiring will be provided under this section.
3. Coordinate location, duct size and confirm that there is proper space for access before releasing for fabrication. Coordinate installation requirements with sheet metal sub-contractor as specified in Section 23 33 00, “Air Duct Accessories”.

C. Dampers:

1. Unless specifically stated otherwise, the outside air, return air and relief air dampers for all air handling units shall be provided under this section of the specifications. Where damper sizes are not shown on drawings, size outdoor air and relief air dampers at 1500 ft/min.

and return air dampers at 2000 ft/min. face velocity. Discharge dampers shall be furnished on systems over 5000 CFM. Where so indicated, provide separate minimum and maximum

2. O.A. damper.
3. Return air, relief air and discharge dampers to be smoke rated on systems over 15,000 CFM and arranged to close in response to smoke detector or function as specified in an engineered smoke control system.
4. Turn dampers over to sheet metal contractor for installation as specified in Section 23 33 00 - Air Duct Accessories.

D. Line Voltage Thermostats: (Used only for exhaust fans only, not for classrooms HVAC Systems). Provide and wire including necessary outlet box, conduit box and all interconnecting wiring.

E. Room Temperature Sensors:
1. General:
a. Provide a room temperature sensor in each location shown on the drawings.
b. Each room temperature sensor shall be wired to a local control device that shall maintain the established setpoints within the space in response to time, mode and temperature inputs.
c. Each sensor shall have a digital display and an override button.
2. Room Temperature Sensor Mounting:
a. In classrooms and offices, each room sensor shall be installed immediately inside door, next to the light switch with its center approximately 4'-0" above the floor. Each room sensor mounted on an exterior wall of the building with an insulating block of wood or other approved material.
b. In public spaces and other unsupervised areas, locate temperature sensors with its center approximately 7'-0" above the floor.
c. Devices with exposed setpoint adjustment, override switches, or any other operable feature shall be installed at a height in compliance with ADA for the location intended.

F. Thermostat/Temperature Sensor Guard: For schools, install in all public spaces and other unsupervised areas (Lockable Lexan covers). Not required in offices or classrooms unless called for on the drawings.

G. Carbon Dioxide Monitor - Controller: Install in the space or duct as shown on the drawings.

H. Indoor Air Quality Sensor:
1. Install in return airstream as shown.
2. Set IAQ controller at 100% control point. With ASHRAE recommended O.A. CFM as listed in the schedule or provided by the engineer and the building normal occupancy, trend the output signal for 30 days. At the end of the 30 day period, set the IAQ controller at a setpoint equal to the "lowest air quality signal" (poorest air quality). Controller shall then operate to modulate the O.A. damper from the "highest minimum O.A." quantity to the "lowest minimum O.A." to hold the setpoint. (The "lowest air quality signal" is that output which meets ASHRAE Standard 62 with normal occupancy. Reducing the O.A. below this is permissible due to lower occupancy or less contaminants.

3.3 SOFTWARE ENHANCEMENTS

A. After the system has operated properly for 90 days following start-up of the final component of the heating and air conditioning systems, an as-built copy of the software shall be transmitted to the owner for permanent record purposes. An allowance shall also be included for any software upgrading or enhancements to improve the system operation or as required for proper operation of the system during the first year of operation. Any changes to the software shall be immediately transmitted to the owner.

3.4 CALIBRATION AND TESTING

A. The Building Control Contractor shall calibrate all building controlled system equipment and verify operation before this system is placed on-line. All testing, calibrating, and adjusting shall be completed by the contractor prior to the start of the acceptance test; including all DDC control loops, interlocks, sequences, energy management programs, and alarms shall be tested, and proper operation verified.

B. The Product Integrated Controls shall be factory installed, configured, and tested for stand-alone operation. Specific configuration, such as setpoints and time schedules, shall be completed before the HVAC equipment on which it is installed and is placed in operation. All testing, calibrating, and adjusting of individual HVAC equipment PIC controls shall be done as a part of that individual unit start-up and acceptance. Only the PIC's network communications function shall be included with the automation (BCS) acceptance test.

3.5 ACCEPTANCE TEST

A. After start-up and calibration, the building controls sub-contractor shall submit to the engineer trend logs of all points on each system demonstrating stable and proper operation. The demonstration shall cover the following conditions:

1. Cooling Only (O.A. Temperature > 70-degrees F).
2. Cooling and Heating (O.A. Temperature 55 degrees F to 70 degrees F).
3. Heating Only (O.A. Temperature < 40-degrees F).

B. The trend logs shall be as follows:

1. 24-hour period at 15-minute intervals.
2. 3 hour start-up period at 5 minute intervals.
3. A total of two sets covering two days during each period are required.

C. After submission of the logs for any one of the periods, the engineer will review them for acceptability, and if acceptable, schedule a final walk-thru of the system for final acceptance and start of hardware warranty.

D. During the hardware warranty period, the controls sub-contractor shall submit trend data covering the other two periods. Any adjustments or modifications to get acceptable results in each period shall be considered to be part of the warranty obligation.

3.6 SEQUENCE OF OPERATION

A. See drawings for sequence of operation.

END OF SECTION

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SECTION 23 09 93 - SEQUENCE OF OPERATION FOR HVAC CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

B. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Provide all labor, material, documentation and services required for the tie-in and implementation of the new air handlers and VAV's into the existing EMS system.

B. Module expansion shall be provided if required to allow for the additional control points.

1.3 RELATED WORK

A. Section 23 09 00, "Instrumentation and Control for HVAC".

1.4 APPLICABLE PROVISION

A. Were modulation of a valve or damper is referred to then it shall mean the direct digital control of the valve or damper based on a control algorithm resident in the BCS software at the remote field panel. Unless noted otherwise the control algorithm shall be PID control. Optimum loop response shall be ensured by the use of a built in automatic loop tuner.

B. An Operator having the required level of password access shall be able to modify the existing Operator changeable or definable parameter(s) on-line from an I/O device such that the monitoring and control functions of the BCS shall not be affected during the period of the change. The mechanism by which the change is made shall be simple and shall be adequately described in the Operator's manuals. Where setpoints for control parameters such as setpoint or changeover temperatures, humidities, or times are referred to in this Section they shall be Operator changeable on-line.

C. Where the sequences refer to the start/stop of a system this shall be initiated either by an Operator manually entered command or automatically by a software routine such as "Optimum Stop/Start", "Power Demand Control", "Programmed Stop/Start", etc. or via an interlock in the sequences of operation to other equipment or event(s).

D. When the motor controller is equipped with a HOA the motors shall only be controlled by the BCS when the HOA switch is in the auto position.

E. Fire stats, freeze stats, smoke and fire detectors and interlocked dampers shall be wired to shutdown motors when the HOA switch is in both the hand and auto positions. It shall not be possible for the BCS to override these or any other safety devices or any fire alarm system control functions, except in the case of an engineered smoke control system in which case freeze protection safeties shall be overridden.

F. Refer to the Point Definition Sheets and System Schematics, which form part of these Contract Documents, to facilitate the interpretation of the sequences of operation as defined herein.

G. Provide additional I/O points, whether or not such points are indicated in the Point Definition Sheets, if they are required in order to attain the requirements of the Contract Documents.

H. Where fans and dampers are to be interlocked, provide hardwire interlocks between the motor terminal strip and damper such that the damper shall be driven open when the motor is required to start. Motor start-up shall not occur until the damper end switch indicates the damper is in the full-open position.

I. Where fans and dampers are hardwire interlocked, the interlocks shall apply in both the "hand" and "auto" positions of the HOA switch at the motor controller.

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J. Where electric heat coil control calls for the electric heating coil to be staged/cycled on and off to maintain the required temperature set point, the control algorithm shall incorporate a deadband, changeable by the Operator, which shall prevent the too frequent on/off cycling of the heating coil.

K. Where electric heating coils are controlled by the BCS, the BCS shall not override any safety interlocks.

L. Where there are fans not identified within the sequence of operation, point definition sheets or schematic drawings that provide supply and/or exhaust air that are not controlled via a thermostat, they shall be hardwire interlocked to the controlling device. The supply fans shall be hardwire interlocked with their associated exhaust fan (if applicable) to operate simultaneously. The dampers shall be hardwire interlocked with the fans via end switches such that the fans cannot operate when the damper is not fully open. The damper status shall not be monitored by the BCS. If the supply or exhaust fan serves a riser with multiple dampers, the end switches of the riser dampers shall be wired in parallel as a group then wired in series with the fan's associated damper end switch to prevent the fan from operating unless both the fan's damper is open and at least one of the riser dampers are open.

M. The point list is provided for convenience and is not intended to be all inclusive. All points required to provide the Sequence of Operation shall be included as if listed. All points required by specification section 23 09 00 not listed in 23 09 93 will be required.

N. All wiring required to provide the Sequence of Operation shall be included.

1.5 ABBREVIATIONS

AFD	Adjustable Frequency Drive
AUX	Starter Auxiliary Contact
AI	Analog Input
AO	Analog Output
CFM	Air Flow in CFM from Air Monitor
CSR	Current Sensing Relay
D	Damper Operation
DI	Digital Input
DO	Digital Output
DP	Differential Pressure
ES	End Switch
Fa	Failure Alarm
FR	Freeze stat
FS	Flow Switch
H	Humidity Sensor
Ha	High Static Pressure Alarm
IAQ	Indoor Air Quality
IGV	Inlet Guide Vanes
La	Low Static Pressure Alarm
Ma	Maintenance Alarm
Pd	Discharge Static Pressure
Pdd	Downduct Static Pressure
Pds	Discharge Static Pressure Safety
Ps	Suction Static Pressure

Pss	Suction Static Pressure Safety
R	Relay
Sa	Safety Alarm/Shut-down
SD	Smoke Detector
DP	Static Pressure Sensor
SR	Damper Smoke Rated
SS	Start-Stop
T	Temperature Sensor
Ta	Temperature Alarm
V	Valve Operator
VP	Virtual Point
X	Hardwired

PART 2 - PRODUCTS

(NOT APPLICABLE)

PART 3 - EXECUTION

3.1 SEQUENCE OF OPERATION

A. Refer to drawings for sequence of operations for equipment on this project.

END OF SECTION

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SECTION 23 21 13 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

B. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Chilled Water (CHWS+R) and Condenser Water (CWS+R) Piping.

B. Equipment Drain (D) Piping.

C. A/C Unit Condensate Drain (CD) Piping.

D. Refrigerant (RS/RL/RHG) Piping.

1.3 DEFINITIONS

A. The pipe sizes given in this document are nominal.

1.4 QUALITY ASSURANCE

A. All material provided under this section shall be standard catalogued products of recognized manufacturers regularly engaged in the production of such products and shall be of the manufacturer's most recent design that is in regular production.

B. Each item provided under this section shall meet the requirements for that item as installed and used, in accordance with the following standards:

1. Metallic Piping Systems employing mechanical joints and grooved-end pipe - ASME/ANSI B-31.9
2. All other metallic piping - ASME/ANSI B31.1.
3. Refrigeration Piping - ASME/ANSI B31.5
4. Polypropylene Piping - ASTM F 2389-07/ANSI 14.

C. Each piping system shall be in accordance with the system design pressures shown in paragraph 2.1 - Materials, this specification section.

D. All materials provided under this section shall be new, except where the specifications and/or drawings permit the reuse of certain existing materials.

E. Source Limitations: Unless specifically noted otherwise, provide products of the same manufacturer for each type of unit specified.

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this section to the extent referenced. The publications are referenced in the text by the basic designation only.

B. The work and materials listed in this Section shall be provided in accordance with the standards and requirements set forth in the applicable portions of the latest editions of the referenced publications. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.

1. American National Standards Institute (ANSI) Standards
2. American Petroleum Institute (API) Specification
3. American Society of Mechanical Engineers (ASME) Publications
4. American Society for Testing and Materials (ASTM) Publications
5. American Welding Society (AWS) Publication
6. American Water Works Association (AWWA) Standards

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7. Cast Iron Soil Pipe Institute (CISPI) Standards
8. The Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS) Publications
9. National Fire Protection Association (NFPA) Standards
10. National Sanitation Foundation (NSF) Testing Laboratory Standards.
11. Plastic Pipe Institute (PPI) Manual.
12. Underwriters Laboratories (UL)

1.6 SUBMITTALS

A. All submittals shall be made in accordance with Division 1 requirements.

B. Submit a list identifying the specific type of material that will be used for each piping system. Include pipe, pipe fittings, valves and joints. Include the basic designation of the publication applicable for each type of material and method.

C. Submit current welder qualifications for all welders proposed for this project. Welding certificates shall be for the company performing the welding at this project as directed in paragraph 3.2 - WELDING, BRAZING, AND SOLDERING.

D. Submit certified welding inspection reports as directed in paragraph 3.2 - WELDING, BRAZING, AND SOLDERING.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Chilled Water and Condenser Water Piping.

1. Pipe and Piping Products:
   a. Pipe shall be manufactured from a PP-R resin (Fusiolen) meeting the short-term properties and long-term strength requirements of ASTM F 2389 or CSA B137.11. The pipe shall contain no rework or recycled materials except that generated in the manufacturer’s own plant from resin of the same specification from the same raw material. All pipes shall be made in an extrusion process. All pipes shall comply with the rated pressure requirements of ASTM F 2389 or CSA B137.11. All pipes shall be certified by NSF International as complying with NSF 14, and ASTM F2389 or CSA B137.11.
   b. Pipe shall be Aquatherm® or Blue Pipe ®, available from Aquatherm, NA. Piping specifications and ordering information are available at www.aquatherm.com.
2. Fittings:
   a. Fittings shall be manufactured from a PP-R resin (Fusiolen) meeting the short-term properties and long-term strength requirements of ASTM F 2389. The fittings shall contain no rework or recycled materials except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. All fittings shall be certified by NSF International as complying with NSF 14, and ASTM F 2389 or CSA B137.11.
   b. Fittings shall be Aquatherm® Green Pipe® or Blue Pipe® available from Aquatherm, NA. Fittings specifications and ordering information are available at www.aquatherm.com.
   c. Fittings shall be installed according to the manufacturer’s instructions.
3. Warranty:
   a. Manufacturer shall warrant pipe and fittings for 10 years to be free of defects in materials or manufacturing.
      i. Warranty shall cover labor and material costs of repairing and/or replacing

defective material and repairing any incidental damage caused by failure of the piping system due to defects in materials or manufacturing.

ii. Warranty shall be in effect only upon submission by the Contractor to the manufacturer, valid pressure/leak test documentation indicating that the system was tested and passed the manufacturer's pressure/leak test.

4. Valves:

a. Valves shall be manufactured in accordance with the manufacturer's specifications and shall comply with the performance requirements of ASTM F 2389 or CSA B137.11. The valves shall contain no rework or recycled thermoplastic materials except that generated in the manufacturer's own plant, from resin of the same specification from the same raw material.

b. Valves shall be Aquatherm® available from Aquatherm, NA. Valve specifications and ordering information are available at www.aquatherm.com.

5. Smoke and Fire Ratings

a. Where indicated on the drawings, that a plenum-rated piping system is needed, the pipe shall be wrapped and/or insulated with standard pipe insulation, field installed. The pipe wrap or insulation shall meet the requirements of CAN/ULC-S102.2-03 or ASTM E84. The system shall have a Flame Spread Classification of less than 25, and Smoke Development rating of less than 50.

6. UV Protection:

a. Not required for externally insulated piping.

7. Thermal and Vapor Barrier

a. Insulation materials furnished and installed hereunder should meet the minimum thickness requirements of American Society of Heating, Refrigeration, and Air Conditioning Engineers ASHRAE 90.1 (current edition), "Energy Efficient Design of New Buildings." However, if other factors such as condensation control or personnel protection are to be considered, the selection of the thickness of insulation should satisfy the controlling factor.

b. Where standard pipe insulation is indicated on the drawings or in these specifications, the contractor shall provide a thermal and vapor barrier insulation. The insulation products shall be provided as indicated on the drawings or elsewhere in these specifications. The standard pipe insulation shall be UV resistant, CFC-free, non-porous, non-fibrous, and resist mold growth.

B. Equipment Drain (D) Piping.

C. System Design Pressure: 10 psig.

1. Piping, 1/4 inch thru 1 inch: Type L Hard-drawn Copper Tubing: ASTM B88.

2. Piping, 1 inch thru 2 inch: Schedule 40 carbon steel, seamless, galvanized; ASTM A-106, Grade B, Type S.

3. Piping, 2-1/2 inch thru 10 inch: Schedule 40 carbon steel, seamless or electric resistance welded, galvanized; ASTM A-53, Grade B, Type S or ERW.

4. Pipe Fittings, 1/4 inch thru 1 inch: Wrought Copper, ANSI B16.22.

5. Pipe Fittings, 1-1/2 inch and larger: 125 lb. rated galvanized malleable iron, threaded type; ASTM A-197.

6. Solder: Lead-free, per code.

7. Unions: 1/4 inch thru 1 inch: Wrought Copper, Pressure Class 150, w/solder ends.

8. Unions: 1 inch thru 2 inch: Malleable Iron, Pressure Class 150, w/ threaded ends, ANSI B 16.39.

Note: Dielectric unions shall be used to connect copper to steel pipe and shall have metal connections on each end threaded to match the adjacent piping. Metal components shall be separated by a nylon insulator to prevent current flow between dissimilar metals. Unions shall be suitable for the system operating pressures and temperatures.

9. Flanges: 150 lb. forged carbon steel, threaded type, with raised face, bored to match the mating pipe I.D.; ANSI B16.3.
10. Bolting studs: ASTM A-193, Grade B7. Nuts shall be heavy duty hex type; ASTM A-194, Grade 2H.
11. Gaskets: Full faced style, 1/8 inch thick. Gasket material shall be Nitrile (NBR) sheet, ASTM F104, Line Call Out F712100A9B4E22K5M6; Based on Garlock Blue-Gard® Style 3300 or acceptable equivalent.
12. Mechanical joints, grooved-end type, may be used on 2-1/2 inch IPS and larger. See paragraph 2.2 "Mechanical Joint Systems", this section, for specifications.

D. A/C Unit Condensate Drain (D) Piping.

E. System Design Pressure: 10 psig.

(Where two materials are listed, either may be used.)

1. Drains in Return Air Plenums or other areas - Copper:
   a. Piping, 1/4 inch thru 4 inch: Type L Hard-drawn Copper Tubing: ASTM B88.
   b. Pipe Fittings, 1/4 inch thru 4 inch:
      i. Wrought Copper, ANSI B16.22.
      ii. Mechanically formed tee fitting, as created by T-Drill, is an acceptable method of installation.
   c. Solder: Lead-free, per code.
   d. Brazing for Mechanically formed tee fittings: Brazing: Contractors Option:
      i. 5% silver, 6% phosphorus, balance copper, 1190-degrees F melting point. AWS A5.8 number BCuP -3. J.W. Harris Stay-Silv® 5 or equal.
      ii. 15% silver, 5% phosphorus, balance copper, 1190-degrees F melting point. AWS 5.8 number BCuP-5. J.W. Harris Stay-Silv® 15 or equal.
      iii. 6% silver, 6.1% phosphorus, balance copper, 1190-degrees F melting point. QQ-B-654A number BCuP -5. J.W. Harris Dynaflow® 5 or equal
   e. Unions: 1/4 inch thru 4 inch: Wrought Copper, Pressure Class 150, w/solder ends.

      Note: Dielectric unions shall be used to connect copper to steel pipe and shall have metal connections on each end threaded to match the adjacent piping. Metal components shall be separated by a nylon insulator to prevent current flow between dissimilar metals. Unions shall be suitable for the system operating pressures and temperatures.
2. Drains in Return Air Plenums Area or other areas - Galvanized:
   a. Piping, 1 inch thru 2 inch: Schedule 40 carbon steel, seamless, galvanized ASTM A-106, Grade B, Type S. Piping, 2-1/2 inch thru 4 inch: Schedule 40 carbon steel, seamless or electric resistance welded, galvanized; ASTM A-53, Grade B, Type S or ERW.
   b. Pipe Fittings, 1 inch and larger: 125 lb. rated, galvanized malleable iron, threaded type; ASTM A-197.
   c. Flanges: 150 lb. forged carbon steel, threaded type, with raised face, bored to match the mating pipe I.D.; ASTM A-181, Grade 2, or ASTM A-105, Grade 2. Flanges shall have the manufacturer's trademark affixed in accordance with MSS SP-25.

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d. Bolting studs: ASTM A-193, Grade B7. Nuts shall be heavy duty hex type; ASTM A-194, Grade 2H.

e. Gaskets: Full faced style, 1/8 inch thick. Gasket material shall be Nitrile (NBR) sheet, ASTM F104 Line Call Out F712100A9B4E22K5M6; Based on Garlock Blue-Gard® Style 3300 or acceptable equivalent.

f. Mechanical joints, grooved-end type, may be used on 2-1/2 inch IPS and larger. See Mechanical Joint Systems", this section, for specifications.

3. Drains, Indoor, not in Return Air Plenums - PVC:

a. Schedule 40 Polyvinyl Chloride (PVC), ASTM D1785.

b. Schedule 40 PVC, socket-type, ASTM D2466. Joints shall be made with solvent cement, ASTM D2564.

F. Refrigerant (RS/RL/RHG) Piping.

G. System Design Pressure: 300 psig.

1. Piping carrying Refrigerants shall be either ACR copper, or carbon steel.

2. ACR Copper Refrigerant Piping:

a. Piping, 3 inch and smaller: Type ACR hard-drawn copper tubing, ASTM B88, ANSI H23.1.

b. Fittings, 3 inch and smaller, all types, wrought copper: ASTM B16.22, ANSI B16.22. All 90° elbows shall be the long radius type.

c. Brazing: Contractors Option:

iv. 5% silver, 6% phosphorus, balance copper, 1190-degrees F melting point. AWS A5.8 number BCuP -3. J.W. Harris Stay-Silv® 5 or equal.

v. 15% silver, 5% phosphorus, balance copper, 1190-degrees F melting point. AWS 5.8 number BCuP-5. J.W. Harris Stay-Silv® 15 or equal.

vi. 6% silver, 6.1% phosphorus, balance copper, 1190-degrees F melting point. QQ-B-654A number BCuP -5. J.W. Harris Dynaflow® 5 or equal

d. Unions used shall be specifically designed for refrigeration piping.

2.2 MECHANICAL JOINT SYSTEMS

A. General:

1. All couplings, fittings, and gaskets shall be the products of a single manufacturer.

2. Valve ends shall be compatible with the couplings used on the connecting piping.

3. All exposed piping shall be cleaned, removing all rust, primed, and painted black. At substantial completion, all exposed piping shall be free of rust and in a “like new condition”.

B. Pipe Wall Thickness (Schedule Number):

1. Where rolled groove joints are used, the pipe wall thickness may, in some cases, be decreased below that specified for the particular fluid system. In all cases, the minimum pipe wall thickness shall be in accordance with ANSI/ASME B31.9, Chapter II, using 150% of the system operating pressure as the design pressure.

2. Pipe having cut (machined) grooves shall have a nominal wall thickness of not less than the wall thickness specified for Schedule 40 pipe of the particular pipe size.

3. Non-metallic pipe shall not be joined with grooved-end pipe mechanical joints.

C. Couplings:

1. Mechanical joint couplings shall be of the external type, for use with cut or rolled-groove end pipes, fittings, and valves.

2. Couplings shall be self-centering and shall engage and lock-in-place the grooved-end pipes, fittings, and gaskets.
3. All couplings shall be of the rigid style. Flexible couplings shall not be used without the written approval of the Engineer.
4. Couplings shall be Ductile Iron, ASTM A536; or malleable iron, ASTM A47, and shall be designed for not less than 250 psig at 230-degrees F.
5. The coupling assembly shall be held together by two or more track-head, oval-neck steel bolts, ASTM A183.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Furnish and install piping, fittings and appurtenances required to complete the piping systems shown on the drawings. Elbows shall be long radius type. Tees may not be field fabricated.
2. Run piping to true alignment, generally parallel or perpendicular to building walls, floors and ceilings, and with uniform grades and spacing, so as to present a neat and workmanlike appearance.
3. Care shall be paid to the exact locations of piping with respect to equipment, ducts, conduits, slabs, beams, lighting fixtures, columns, ceiling suspension systems, etc. to provide maximum access to mechanical and electrical equipment in the building. Close coordination and cooperation shall be exercised with other trades in locating the piping in the best interests of the Owner. The drawings and specifications covering other work to be done in the building shall be carefully studied and arrangements made to avoid conflict.
4. Not all necessary pipe offsets are indicated on the drawings because of the small scale. The various runs of piping to be installed shall be studied and adjustments made in exact routings as may be required for proper installation.
5. Conflicts arising during the erection of piping shall be brought to the attention of the Owner's Representative. No improvising or field changes will be permitted without the approval of the Owner's Representative.
6. Use full lengths of pipe wherever possible. Short lengths of pipe with couplings will not be permitted. Cut to exact measurement and install without forcing or spring unless otherwise shown on the drawings or specified.
7. Avoid tool marks and unnecessary pipe threads. Burrs formed when cutting pipe shall be removed by reaming. Before installing any pipe, care shall be taken that the inside is thoroughly cleaned and free of cuttings and foreign matter. Measures shall be taken to preserve this cleanliness after erection.
8. Arrange pipe connections to valves and specialties so that there is clearance for easy removal of the valve or specialty from the line, and also for the removal of the valve bonnet and interior, and the specialty top and bottom and interior, except where otherwise approved by the Owner's Representative.
9. Erect piping in such a manner so as to obtain sufficient flexibility and to prevent excessive stresses in materials and excessive bending movements at joints or connections to equipment. Make allowances throughout for expansion and contraction of piping. Provide each riser and horizontal run of piping with expansion loops, expansion joints, or expansion compensators where indicated and required. Securely anchor and adequately guide pipe as required or where indicated to force expansion to the expansion device without bending, binding, or misalignment of pipe. Branch connections from mains to risers shall be made with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Where indicated, in lieu of expansion loops, expansion joints, or expansion compensators,

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horizontal runs of pipe shall be anchored at approximately midway of the run to force expansion, evenly divided, toward the mains and risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that piping will spring enough to allow for expansion without straining.

10. Installed piping shall not interfere with the operations or accessibility of doors or windows and shall not encroach on aisles, passageways and equipment, and shall not interfere with the servicing or maintenance of any equipment. Adjacent pipelines shall be grouped in the same horizontal or vertical plane.
11. Where lines are purposely pitched for drainage, an accurate grade shall be maintained. No lines shall be supported in such a manner as to permit deflection, due to gravity, sufficient to pocket the lines when full of liquid. Grade mains as indicated by arrows on the drawings and in accordance with gradient as indicated in attached Piping Schedule.
12. Piping found to have water hammer or other objectionable vibrations which cannot be eliminated by proper grading or other natural means, shall be braced, trapped, or hung with shock absorbing hangers and equipped with air chambers, mechanical shock absorbers, flexible pipe connections or otherwise silenced using approved means.
13. Use building steel wherever possible for supporting pipe hangers. Main structural steel shall not be drilled, cut or burned for hangers without the approval of the Owner's Representative. Expansion bolts shall be used only upon the approval of the Owner's Representative.
14. Install unions or flanges in piping connections to equipment, regulating valves, and wherever necessary to facilitate the dismantling of piping and/or removal of valves and other items requiring maintenance.
15. Avoid bushings. Reducing fittings shall be used wherever practical.
16. The drawings indicate the size of piping and connections, and if certain sizes are omitted or unclear, obtain additional information before proceeding.
17. The piping drawings have been worked out with a view to the most economical installation, taking into consideration accessibility and appearances, and the Contractor must follow the drawings accurately and if it is found impractical to install the work in accordance with the drawings and specifications, the Contractor shall notify the Owner's Representative before making any changes and get their approval or revised drawings before proceeding with the work. Verify all measurements on the job before cutting pipes or having piping fabricated, and be responsible for the correct location of all pipe connections, also check sizes and standard of outlets on the equipment, including the dimensions and drilling of flanges, etc.
18. Copper tubing and galvanized steel shall not be mixed in any one run of piping.
19. Change in direction shall be made with fittings, except that bending of steel and copper pipe 4 inches and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. The center-line radius of bends shall be not less than 6 diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations is not acceptable.
20. Threaded joints shall be made with tapered threads in accordance with ANSI B2.1 and made tight with an approved pipe thread joint compound or material, applied to the male threads only. Use compounds sparingly and apply with caution to ensure that compounds do not enter piping systems. When pipe joint is made up a maximum of 3 threads shall be visible.
21. Polypropylene pipe fittings and joints shall be fusion welded in accordance with manufacturer’s specifications and product standards.
22. Connections between ferrous and nonferrous metallic pipe shall be made with dielectric unions or flanges.

23. Connections between plastic and metallic pipe shall be made with transition fittings manufactured for the specific purpose.
24. Unions and flanges shall not be concealed in walls, partitions, or above inaccessible ceilings.

B. Hydronic HVAC Systems Additional Requirements:
1. Provide a 3/4 inch drain valve and a capped hose nipple at each low point in each system, and where indicated.
2. Provide, at each high point in each system, and where indicated, an automatic air vent with drain line routed to the local floor drain.
3. Mechanically formed tee shall be formed in a continuous operation consisting of drilling a pilot hole and drawing out the tube surface to form a tee having a height of not less than three times the thickness of the branch tube wall s as to comply with the American Welding Society lap joint weld. The device shall be fully adjustable as to insure proper tolerance and complete uniformity of the joint. The branch tube shall be notched to conform with the inner curve of the run tube and have two dimple/depth stops pressed into the branch tube (one 1/4 inch atop the other). This is to insure penetration of the branch tube into the tee is of sufficient depth for brazing and that the branch tube does not obstruct the flow in the main line tube. Dimple/depth stops shall be in line with the run of the tube. The second dimple shall be 1/4 inch above the first and shall serve as a visual point of inspection. All mechanical formed tee fittings shall be brazed in accordance with the Copper Development Associations Copper Tube Handbook using BCuP series filler metal. NOTE: Soft soldered joints will not be permitted. Contractor assumes responsibility for joints being installed in accordance with code and manufacturers' recommendations.
4. On liquid systems, make branch connections to top of mains for up-feed arrangement, and to bottom of mains for down-feed arrangement, except where main and branch line are of equal size the branch connection may be made to the side of the main for both up-feed and down-feed applications.
5. Provide water seal in the condensate drain from each air handling or air conditioning unit. The depth of each seal shall be equal to the total static pressure rating of the unit to which the seal is connected. Water seals shall be constructed of two tees and an appropriate U bend with the open end of each tee plugged.
6. Slope piping 1 inch per 40 feet, in the direction of flow.

C. Refrigerant Systems Additional Requirements:
1. Installation shall be in accordance with ANSI B31.5 Refrigeration Piping, unless specified otherwise herein.
2. Brazing procedures and operators shall be qualified in accordance with the requirements of Section IX of the ASME Boiler and Pressure Vessel Code.
3. Refrigerant pipeline accessories that may be damaged by heat shall be disassembled prior to joint brazing. Reassemble accessories after joint brazing operations are completed.
4. Joints shall be made with solder-type fittings. The outside surface of the tube where engaged in the fitting, and the inside surface of the fitting in contact with the tube, shall be cleaned with an abrasive material before brazing. Self-cleaning compounds are not allowed. Care shall be taken to prevent annealing of tube and fittings when making connections. Brazed joints shall be made with flux and the previously specified silver-brazing alloy. The brazing alloy shall be applied and drawn through the full fitting length. Excess brazing alloy shall be wiped from the joint before the brazing alloy hardens. Joints shall be made with heat applied uniformly around the entire circumference of the tube and fittings. Remove all excess flux for a clear visual inspection of all brazed connections.

5. Refrigerant piping installed below concrete slab- on-grade shall be installed in continuous runs without joints and shall be encased in PVC plastic conduit. Ends of conduit shall be sealed watertight.

3.2 WELDING, BRAZING, AND SOLDERING

A. Operator and Procedure Qualifications: All welding and/or brazing operators and all welding and brazing procedures shall be qualified in accordance with the requirements of Section IX of the ASME Boiler and Pressure Vessel Code.

B. Welding:

1. All pipe welding performed under this division of the specifications shall be examined in accordance with ANSI B31.1 requirement for each piping system. The pipe weld examination is hereby made a part of the work of this division of the specifications. An independent outside inspection firm, regularly performing this type of examination, shall be hired by the contractor or subcontractor performing the welding as part of the work of their contract. The examination shall be performed by a representative of the Inspection Company (hereafter called the Inspector) who is qualified and certified for each examination method required.

2. The Inspection Company performing the examination shall certify in writing that all pipe welds performed under this contract conform to the requirements of ANSI B31.1 for each piping system and to all other governing codes.

3. Before final acceptance of the welded piping, certified test reports shall be submitted for review. The reports shall include the following data: name and location of project, date of test, type of piping system, working pressure and temperature, standard used for testing and applicable test method, number and location of welds tested and names of persons performing test.

4. Welders and procedures for fire protection system piping qualified in accordance with NFPA No. 13.

C. Brazing: Silver braze joints in accordance with MSS-SP-73 "Silver Brazing Joints for Wrought and Cast Solder Joint Fittings".

D. Soldering: Joints in copper tubing shall be made with solder-type fittings. Outside surface of the tube where engaged in the fitting, and inside surface of the fitting in contact with the tube, shall be cleaned with an abrasive material before soldering. Self-cleaning compounds shall not be used. Care shall be taken to prevent annealing of tube and fittings when making connections. The solder joint shall be made with flux and wire form solder, except brazed joints. The flux shall be a mildly corrosive liquid, or a petroleum-based paste containing chlorides of zinc and ammonium. Solder shall be applied and drawn through the full fitting length. Excess solder shall be wiped from joint before solder hardens. All joints to be wiped clean after soldering. Joints in copper tube sizes 2-1/2 inches and larger shall be made with heat applied uniformly around the entire circumference of the tube and fittings by a multi-flame torch. Use of oxyacetylene cutting torch in lieu of multi-flame torch is not permitted. Disassemble valves and other accessories that may be damaged by heat before soldering.

E. Piping Identification: All piping shall be marked in accordance with the provisions of Section 23 02 00," Basic Materials and Methods for HVAC Systems".

3.3 TESTING OF PIPING SYSTEMS:

A. Each piping system, after erection, shall be subjected to a pressure test. The test requirements shall be as follows:

1. General: Furnish everything required for the tests. Notify Architect/Engineer at least 48 hours before any testing is performed. Independent Agent/Owner shall verify pressure test and sign off. Report to be furnished to Architect/Engineer. Testing shall be performed at the completion of each phase of the project.

2. HVAC related systems shall be tested with water at 1-1/2 times the system working pressure, but not less than 100 psig. Joints will be visually examined for leaks.
    a. Initial Hydrostatic Test: Before insulation is applied to field connections, hydrostatically pressure test each pipe as a complete unity with fresh water to 150 psig or not less than 1.5 times systems pressure rating, whichever is greater. Pressure testing with air will not be permitted, unless approved prior to testing. Limit pressures rise to 100 psi per minute at beginning of test and pressure drop to 100 psi at conclusion of test. Remove air from system before start of tests. Pressure must hold for a minimum of 4 hours with a 4-psi maximum drop. Examine system for leaks and porosity. Replace porous sections and repair leaks in accordance with pipe manufacturer's instructions, repeat tests until system is proven tight. During a 4 hour pressure holding period, valve off system and completely disconnect method of system pressurization.
    b. Cycle Test: Pressure cycle test system at 150 psig or 1.5 times system pressure rating, whichever is greater, for 10 cycles. Each cycle shall consist of a one-minute period at 150 psig or 1.5 times system pressure rating and a 4-minute period when the pressure is dropped at least 40%. Examine system for leaks and porosity, repair leaks, replace porous pipe, and repeat test until system is proven tight.
    c. Post Cycle Hydrostatic Test: Repeat initial hydrostatic test.
    d. Operational Test: Operate a complete system with water flowing through system. During a 48 hour, cycle system 8 hours on and 8 hours off for 3 complete cycles. Examine system for leaks until system is proven tight.
    e. Second Hydrostatic Test Series: After successful completion of operational testing, repeat first hydrostatic test series sequence. Examine pipe system for leaks and porosity. Repair leaks replace porous pipe, and repeat test until system is proven tight. After successful completion of the second hydrostatic test series, backfill trenches.
    f. Final Hydrostatic Test: After completion of the final phase of construction, repeat the initial hydrostatic test on the entire piping system(s).
3. Leaks, if any, shall be located, repaired, and retested in accordance with the test method specified for the system in which the leaks are located.
4. Refrigerant Piping Systems shall be tested with dry carbon dioxide, or nitrogen, at 315 psig for the high side, and at 245 psig for the low side. If leaks are to be detected by use of an electronic halogen detector, or a halide torch, the system shall be pressurized with refrigerant gas prior to introduction of dry carbon dioxide or nitrogen into the system. Pre-charging of system with refrigerant gas is not necessary for soap bubble leak detection method.

B. Prior to testing a system, the Contractor shall provide the proper Building Official and the Owner's Representative with not less than 24 hours' notice of the proposed test. The Contractor shall obtain approval of the test results. Where written approval is required, the Contractor shall obtain such written approval and submit a copy of the approval.

C. Work requiring testing shall not be covered, or otherwise concealed, until testing is completed, and approval is granted.

D. Work, or portions of work, that is altered in any way after testing and approval shall be retested, witnessed, and approval obtained.

E. Systems requiring hydrostatic tests shall be protected from damage caused by freezing. After tests are completed drain all sections of pipe, including traps, or fill undrained sections and traps with antifreeze solution. Vent all high points to release vacuum and ensure complete drainage of closed systems and blow out piping with compressed air to remove trapped water.

F. Duration of tests, unless specified otherwise, shall be the time required to examine each joint in the system being tested.

G. Systems requiring hydrostatic testing under pressure shall be vented at high points to ensure that all piping is completely filled with the testing medium.

H. Disconnect pressure boosting apparatus, or vacuum pumps, during the test time span specified for systems employing the pressure loss/time span test method.

I. During tests, isolate system components that have test pressures less than pressures specified for system tests.

J. Use clean soapy water applied to exterior of joints to locate leaks in systems using compressed air, dry carbon dioxide, or nitrogen, under positive pressure as a test medium.

3.4 CLEANING OF PIPING SYSTEMS

A. HVAC Piping systems shall be thoroughly cleaned as described in Section 23 25 00, “HVAC Water Treatment”.

END OF SECTION

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SECTION 23 21 23 - HYDRONIC PUMPS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. In-line circulators

B. Vertical in-line pumps

C. Base mounted pumps

D. Side-stream filters

E. Suction diffuser

1.2 REFERENCES

A. UL 778 - Motor Operated Water Pumps

1.3 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacture, assembly, and field performance of pumps with minimum five years of experience.

B. Alignment: A qualified millwright shall align the base mounted pumps and certify the alignment.

1.4 SUBMITTALS

A. Submit product data under provisions of Section 01 33 00.

B. Submit certified pump curves showing performance and efficiency characteristics with selected pump operating point plotted.

1. Include NPSH curve when applicable.

C. Submit manufacturer's installation instructions under provisions of Section 01 33 00.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Section 01 77 00.

B. Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site.

B. Store and protect products.

1.7 WARRANTIES

A. Provide a 5-year warranty on motors of 10-horsepower and greater, see section 23 05 13.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Crane Deming

B. Bell & Gosset

C. Peerless

D. Aurora

E. TACO

F. S.A. Armstrong

2.2 GENERAL CONSTRUCTION REQUIREMENTS

A. Balance: Rotating parts statically and dynamically.

B. Construction: Designed and built to permit servicing without breaking piping or motor connections.

C. Pump Motors: Operate at 1800 maximum rpm (Refer to Section 23 05 13).

D. Pump Connections: Flanged.

E. Chilled water and condenser water pumps shall be base mounted end suction type.

F. All pumps operated by a variable frequency drives shall have electric motors that are inverter duty rated, see section 23 05 13.

2.3 BASE MOUNTED PUMPS

A. Type: End suction, horizontal shaft, single stage, long coupling drive; 175 psig maximum working pressure, end suction, back pullout.

B. Casing: Cast iron, with suction and discharge gage ports, seal flush connection, drain plug, flanged suction, and discharge.

1. The casing drain is not to be used as a port.

C. Impeller: Bronze or stainless steel, fully enclosed keyed to shaft.

D. Bearings: Grease lubricated roller or ball bearings.

E. Shaft: Shall be stainless steel with a copper, bronze, or stainless steel shaft sleeve.

F. Seal: Carbon rotating against a stationary ceramic seat, Viton fitted 225-degrees F maximum continuous operating temperature.

G. Drive: Flexible coupling with coupling guard, woods type.

H. Base plate: Shall be cast iron or fabricated steel with integral drain rim.

I. Provide manufacturer’s Model and Serial identification plate specifying GPM and impeller diameter firmly secured to pump assembly.

J. Pump motors shall be TEFC Premium Efficiency inverter duty rated and suited for the environment in which they are installed.

K. Pump motor RPM shall be 1800 or less.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install pumps in accordance with manufacturer's instructions.

B. Provide access space around pumps for service.

1. Provide no less than minimum as recommended by manufacturer.

C. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 5% of midpoint of published maximum efficiency curve.

D. Decrease from line size with long radius reducing elbows or reducers.

1. Support piping adjacent to pump so that pump flex-connector and casings do not carry any weight.

2. For close coupled or base mounted pumps, provide supports under elbows on pump suction and discharge line sizes 4" and over.

3. Refer to Section 23 05 48, Vibration Isolation.

E. Provide line sized shut-off valve and suction diffuser on pump suction, and line sized shut-off valve on pump discharge.

F. Provide air cock and drain connection on horizontal pump casings.

G. Provide drains for bases and seals, piped to and discharging into floor drains.

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H. Lubricate pumps before start-up.

I. Install base mounted pumps on rigid concrete base or on concrete inertia base (refer to plans), with anchor bolts, set and level, and grout in place.

J. Qualified millwright shall check, align, and certify base mounted pumps prior to start-up.

K. If pump does not meet designed performance within 5% then upgrade pump at no cost to Owner.

L. All base mounted pumps shall have vibration isolation provided at both pipe connections.

M. Install all base mounted pumps with motors facing the center of the room or compound.

N. Pump and motor metal support frame shall be cleaned, primed, and finish painted in accordance with Sections 09 91 13 or 09 91 26).

O. Pumps circulating cold water shall be insulated in such a fashion that the insulation can be removed for servicing and re-assembled without damaging the integrity of the insulation assembly.

P. For larger pumps, provide operating pressure gauge connected to suction and discharge pump ports with isolation valves and pressure bleed. (Refer to piping detail in plans.)

3.2 DEMONSTRATION AND TRAINING

A. Training of the Owner’s operation and maintenance personnel is required in cooperation with the Owner's Representative.

1. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems.

2. Schedule the instruction in coordination with the Owner's Representative after submission and approval of formal training plans.

B. Provide demonstration and training for all types of HVAC Pumps installed in this project.

END OF SECTION

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SECTION 23 23 16 - REFRIGERATION SPECIALTIES AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

B. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Solenoid valves.

B. Filter driers.

C. Sight glasses.

D. Thermometers.

E. Gauges.

1.3 APPLICABLE REGULATIONS AND REFERENCES

A. ANSI B31.5 Pressure Piping.

B. ANSI/ASHRAE Safety Code for Mechanical Refrigeration.

C. ASME Boiler and Pressure Vessel Code Section VIII.

D. National Electrical Code, NEMA.

E. U.S. Labeled, Electrical Controls.

1.4 ADDITIONAL REGULATORY REQUIREMENTS

A. All pressure vessels ASME inspected and stamped.

1.5 SUBMITTALS

A. Submission for acceptance is not required.

B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

C. Refer to Division 1 for submittal requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Solenoid Valves, Filter Drier, Sight Glasses:

1. Sporlan
2. Alco
3. Hubbell
4. Phillips
5. Henry

B. Thermometers:

1. Mueller
2. Taylor
3. Rochester

C. Gauges:

1. Crosby-Ashton Type AAO
2. Ashcroft

3. Lonergran

2.2 CONSTRUCTION

A. Solenoid Valves:
   1. Liquid line shut off.
   2. Normally closed.
   3. Manual lift stem.
   4. Sized for refrigerant tonnage at 3 psig pressure drop for R-12.
   5. Pilot operated.
   6. Synthetic seat for permanent tight shut-off.
   7. 120 volt solenoid coil (interchangeable).
   8. Top grade brass, bronze and/or semi-steel body materials.

B. Filter Drier:
   1. Replaceable core type.
   2. Heavy steel, cadmium plated with external coat of paint.
   3. All internal parts cadmium plated.
   4. Outlet seal gasket with spring to prevent bypassing.
   5. Copper fittings brazed to steel shell, suitable for soldering with Sil-Fos or Phos-Copper solder.
   6. Molded porous core elements.
   7. Tie rod assembly to permit external assembly with one piece insert.
   8. Bolt and nut attachment.
   9. Size for refrigerant capacity and tonnage at 2 psi pressure drop.

C. Thermometers:
   1. Red reading type, glass front, iron or phenol case, adjustable pattern, separable socket.
   2. Shall have 9 inch scale and 12 inch case.
   3. Operating range shall occur in middle half of total range.

D. Gauges:
   1. Liquid pressure gauges constructed with bronze tube, stainless steel movement, white dial, black micrometer, adjustable pointer, iron case with black flange iron or phenol screwed ring, bottom connection.
   2. Case diameter size shall be 4-1/2 inches minimum.
   3. Operating range shall occur in middle half of total gauge range.
   4. Provide needle valve for all gauges.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all items in strict accordance with manufacturer's instructions.

B. Thermometers:
   1. Install and adjust thermometers for optimum visibility.
   2. Provide thermometers in the following locations:
      a. Ice builders; leaving each builder on the pumped liquid return header.
      b. Barrel chiller entering and leaving the pumped liquid lines.

c. Compressor oil coolers; entering and leaving condenser water lines.
d. Evaporative condenser; entering and leaving refrigerant lines.
e. Refrigerant pumps; entering and leaving the pumped liquid lines.

C. Gauges:
1. Install gauges with dial in vertical position. Locate between shut-off valve and equipment directly adjacent to equipment within normal visual range of operator standing on floor.
2. Provide gauges where shown on drawings, including the following locations:
a. Ice builders; leaving each builder on the pumped liquid return header.
b. Barrel chiller; entering and leaving the pumped liquid lines.
c. Compressor oil coolers; entering and leaving condenser water lines.
d. Evaporative condenser; entering and leaving refrigerant lines.
e. Refrigerant pumps; entering and leaving the pumped liquid lines.

END OF SECTION

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SECTION 23 31 00 - HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

B. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Single Wall Round Ductwork and Fittings.

B. Single Wall Round Snaplock Seam Galvanized Steel Ductwork and Fittings.

C. Double Wall Round Ductwork and Fittings.

D. Round Stainless-Steel Ductwork and Fittings.

E. Single Wall Round Flexible Ductwork.

F. Insulated Round Flexible Ductwork.

1.3 QUALITY ASSURANCE

A. All ductworks shall be fabricated within the guidelines established by the Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) HVAC Duct Construction Standards - Metal and Flexible, latest edition.

B. All ductworks shall be fabricated to withstand the pressure and velocity required on this project.

C. All components, fasteners, sealants, adhesives, etc. in the conditioned air stream or exposed in active or non- active plenums shall conform to the NFPA 90A Standard for the Installation of Air Conditioning and Ventilating Systems and Standard for Flame/Smoke/Fire Contribution of 25/50/0.

D. All ductworks shall conform to UL standard UL 181 Factory Made Air Duct Materials and Duct Connectors, latest edition. Applicable sections shall apply to shop fabricated ductwork.

E. After fabrication and installation of all shop fabricated ductwork the fabricator and installer, if not the same, shall certify in writing to the Owner's representative that all shop fabricated ductwork and installation of same meets or exceeds the quality standards established by SMACNA.

1.4 SUBMITTALS

A. Submission for acceptance is required.

B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

C. Submit in accordance with Division 1 requirements.

1.5 SHOP DRAWINGS

A. Shop Drawings: Provide shop drawings of ductwork as follows:

1. Draw to a scale of not less than 1/4 inch to one foot on the same size sheets as the contract drawings.
2. Show duct sizes.
3. Show fitting details.
4. Show lighting and ceiling diffusers.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Single Wall Round Ductwork and Fittings:

1. Autoduct, Inc.

2. Eastern Sheetmetal
3. Hamlin Sheetmetal, Inc.
4. Impulse Air.
5. Lindab
6. Semco Manufacturing, Inc.
7. United McGill

B. Single Wall Round Snaplock Seam Galvanized Steel Ductwork and Fittings:
1. Alco Manufacturing Company.
2. Crown Products Company.
3. Hughes.

C. Double Wall Round Ductwork and Fittings:
1. Autoduct, Inc.
2. Eastern Sheetmetal
3. Hamlin Sheetmetal, Inc.
4. Impulse Air.
5. Lindab
6. Semco Manufacturing, Inc.
7. United McGill

D. Round Stainless-Steel Ductwork and Fittings:
1. Autoduct, Inc.
2. Eastern Sheetmetal
3. Hamlin Sheetmetal, Inc.
4. Impulse Air.
5. Lindab
6. Semco Manufacturing, Inc.
7. United McGill

E. Single Wall Round Flexible Ductwork:
1. ATCO Rubber Products, Inc.
2. Flexmaster USA, Inc.
3. Flexible Technologies - Thermaflex®

F. Insulated Round Flexible Ductwork:
1. ATCO Rubber Products, Inc.
2. Flexmaster USA, Inc.
3. Flexible Technologies - Thermaflex®

2.2 FABRICATION

A. Single Wall Round Ductwork and Fittings:
1. Materials: Hot rolled, continuously annealed, hot dipped galvanized steel minimum of G-90, 0.90 oz/sf coating, conforms to ASTM A653.
2. Metal Gauges: Conform to the Sheet Metal and Air Conditioning Contractor's National Association, Inc. (SMACNA) HVAC Duct Construction Standards - Metal and Flexible, latest edition. The following table shall establish a minimum guideline unless the

manufacturer has U.L. Standard 181 test results that show that lighter gages (thinner wall thickness) with intermediate corrugations (ribs) allow the gage reduction:

Pipe Diameter	Positive Internal Static Pressure in W.G.					
	0" - 2.0"		2.1" - 4.0"		4.1" - 10.0"	
	Spiral Pipe	Fittings	Spiral Pipe	Fittings	Spiral Pipe	Fittings
6" - 10"	28	26	28	24	28	24
12"	28	26	28	24	26	24
14"	28	26	256	24	26	24
16"	26	24	26	22	24	22
18" - 26"	26	24	24	22	24	22
27" - 36"	24	22	22	20	22	20
37" - 50"	22	20	20	20	20	20
51" - 60"	20	18	18	18	18	18
61" - 84"	18	16	18	18	18	16

3. Duct Construction: Spiral wound, lock seam construction, slip joint or flanged connections as noted below under couplings.
4. Fitting Construction:
   a. 90-degrees and 45-degrees Ells: Solid - welded seam construction for dust collector use, Solid - welded seam or spot welded and bonded for general use. Radiused ells to be full radiused unless otherwise noted, mitered ells to have single thickness, turning vanes, slip joint or flanged connections.
   b. Tees or Crosses: Solid - welded seam construction for dust collector use, Solid - welded seam or spot welded and bonded for general use. Tangential, unless otherwise noted or detailed, conical take off or reduction, slip joint or coupled ends. 180-degrees or 45-degrees as indicated.
   c. Bellmouth: Solid - welded seam construction for dust collector use, Solid - welded seam or spot welded and bonded for general use. Spun metal, smooth converging bellmouth, round, gauge equal or greater than connecting duct.
   d. Access Section:
      i. 7 inch Diameter and Less: Minimum 12-inch-long flanged section, minimum four bolts per flange.
      ii. 8 inch Diameter and Larger: Round or rectangular access cover, on welded raised section, pressure sensitive release suitable for manual release or emergency vacuum release, chain retainer, (see Para. 3.5: Schedules for Sizes).
   e. Couplings:
      i. Joints 36 inches or less shall have 2-inch slip coupling.
      ii. 38 inches or over shall be spiral mate.
   f. Based on United McGill

B. Single Wall Round Snaplock Seam Galvanized Steel Ductwork and Fittings:

1. Materials: Hot rolled, continuously annealed, hot dipped galvanized steel minimum of G-90, 0.90 oz/sf coating, conforms to ASTM A653.
2. Metal Gauges: Minimum of 26 gauge, with remaining sizes conforming to the Sheet Metal and Air Conditioning Contractor's National Association, Inc. (SMACNA) HVAC Duct Construction Standards Metal and Flexible, latest edition. The following table shall establish a minimum guideline:
   Round Ducts:

Duct Diameter	Spiral Pipe	Fittings and Longitudinal Seam Pipe
3" thru 14"	26	24
15" thru 26"	24	22
27" thru 30"	22	20

3. Duct Construction: Snaplock seam construction, slip joint or flanged connections.
4. Fitting Construction:
   a. 90-degrees and 45-degrees Ells: Adjustable ells to be full radiused unless otherwise noted, slip joint or flanged connections.
   b. Tees or Crosses: Adjustable, unless otherwise noted or detailed, conical take off or reduction, slip joint or coupled ends. 180-degrees or 45-degrees as indicated.

C. Double Wall Round Ductwork and Fittings:
1. Materials:
   a. Outer Duct: Hot rolled, continuously annealed hot dipped galvanized steel, minimum G- 90, 0.90 oz/sf (.001 inch thick/side) coating, conforms to ASTM 653.
   b. Liner: 1 inch thickness flexible fibrous glass minimum density 1.5 lb./cf., maximum conductivity per 1" thickness of .27 at 75-degrees F mean temperature with a mylar coating.
   c. Inner Duct: Hot rolled continuously annealed, perforated hot dipped, galvanized steel, minimum G-90, 0.90 oz/sf (.001 inch thick/side) coating, conforms to ASTM 653.
2. Metal Gauges:
   a. Outer Duct: Conform to the Sheet Metal and Air Conditioning Contractor's National Association, Inc. (SMACNA) Duct Construction Standards, Metal and Flexible, latest edition. The following table shall establish a minimum guideline unless the manufacturer has U.L. Standard 181 test results that show that lighter gages (thinner wall thickness) with intermediate corrugations (ribs) allow the gage reduction:

      Round Ducts:

	Spiral Pipe		Fittings	
Inside Dia.	Shell	Perf. Liner	Shell	Perf. Liner
3” thru 8”	24	26 Non-Ribbed	24	24
9” thru 12”	24	28 Ribbed	24	24
13” thru 24”	22	28 Ribbed	22	24
25” thru 34”	20	28 Ribbed	20	24
35” thru 48”	20	28 Ribbed	20	22
49” thru 52”	18	28 Ribbed	18	22
53” thru 58”	18	26 Ribbed	18	22
59” thru 62”	16	26 Ribbed	16	22
63” thru 82”	16	22 Non-Ribbed	16	22

3. Duct Construction:
   a. Outer Duct: Spiral wound, lock seam construction, slip joint or flanged connections as noted below under couplings.
   b. Inner Duct: Spiral wound, lock seam construction, slip joint connections, mechanically bound to outer duct for vertical installation.
4. Fitting Construction:
   a. 90-degrees and 45-degrees Ells: Die formed or welded segmented construction, radiused ells to be full radiused unless otherwise noted, mitered ells to have single thickness turning vanes, liner and inner duct continuous.
   b. Tees or Crosses: Tangential unless otherwise noted, conical take off or reduction coupled ends, 180-degrees or 45-degrees as indicated.
   c. Bellmouth: Spun metal smooth converging bellmouth, round, single wall gauge equal to or greater than connecting duct.

d. Access Section:
   i. 7 inch Diameter and Less: Flanged section, minimum four bolts per flange. Double wall section.
   ii. 8 inch Diameter and Larger: Round or rectangular access cover, on welded raised sections, pressure sensitive release suitable for manual release or emergency vacuum release, chain retainer, (see Para. 3.5 - Schedules for Sizes).

e. Couplings:
   i. Joints 36 inches or less shall have 2 inch slip coupling.
   ii. 38 inches or over shall be spiral mate.

f. Based on United McGill

D. Round Stainless-Steel Ductwork and Fittings:

1. Materials: Exhaust duct shall be constructed of 304 or 316 stainless steel as scheduled with a 2B mill finish.

2. Metal Gauges: Conform to the Sheet Metal and Air Conditioning Contractor's National Association, Inc. (SMACNA) Duct Construction Standards, Metal and Flexible, latest edition. The following table shall establish a minimum guideline unless the manufacturer has U.L. Standard 181 test results that show that lighter gages (thinner wall thickness) with intermediate corrugations (ribs) allow the gage reduction:

Round Ducts:

Pipe Diameter	Negative Internal Static Pressure in W.G.					
	0” - 2.0”		2.1” - 6.0”		6.1” - 10.0”	
	Spiral Pipe	Fittings	Spiral Pipe	Fittings	Spiral Pipe	Fittings
9” - 15”	26	24	24	22	24	22
16” - 26”	24	22	22	20	20	18
28” - 36”	22	20	20	18	18	16
38” - 50”	20	18	18	16	18**	16
52” - 60”	18	16	16	14	18**	16*
* Companion Angle Rings Required.						
** Girth Rings Required 60 Inches O.C.						

3. Duct Construction: Round and oval ducts shall be of the spiral lock seam or all welded construction.

4. Fitting Construction: Fittings shall be factory fabricated with all seams continuously welded.

5. Fitting Type: Refer to Section 2.2.A.4.

6. Joints:

   a. Joints 36 inches or less shall have 2-inch slip coupling.

   b. 38 inches or over shall be spiral mate.

E. Uninsulated Round Flexible Ductwork:

1. High Pressure Application: Factory fabricated assembly of a trilaminate of aluminum foil, fiberglass, and polyester with a perm rating of .02 high tear strength and properties to resist temperature change, mildew and age hardening. It shall be mechanically locked, without adhesives, into a formed aluminum helix on the ducts outside surface and be U.L. listed 181 Class 1 and comply with NFPA 90A and 90B. The material shall have a pressure rating of 12 inch w.g. positive pressure and -5 inch w.g. negative pressure through a temperature range of -20□F to +250□F. Based on Type NI-35 as manufactured by Flexmaster U.S.A., Inc., ATCO Rubber Products UPC #7 or Flexible Technologies – Thermaflex S-LP-10.

F. Insulated Round Flexible Ductwork:

1. High Pressure Application:

a. Factory fabricated assembly of a trilaminate of aluminum foil, fiberglass and polyester with a perm rating of .02, high tear strength and properties to resist temperature change, mildew and age hardening. It shall be mechanically locked, without adhesives, into a formed aluminum helix on the ducts outside surface and be U.L. listed 181 Class 1 and comply with NFPA 90A and 90B. The material shall have a pressure rating of 12-inch w.g. positive pressure and -5 inch w.g. negative pressure through a temperature range of -20-degrees F to +250-degrees F.

b. The duct material shall be factory wrapped in a blanket of fiberglass insulation with a C factor of .23 or less. The insulation shall be encased in a fire-retardant reinforced aluminum material vapor barrier with a perm rating of not over .05 grains per square ft. per hour per inch of mercury.

c. Based on Type 3M as manufactured by Flexmaster U.S.A., Inc., ATCO Rubber Products UPC #036 or Omni Air 1200, or Flexible Technologies - Thermaflex M- KF.

2. Low Pressure Application:

a. Factory fabricated assembly of a tri-laminate of aluminum foil, fiberglass and polyester with a perm rating of .02, high tear strength and properties to resist temperature change, mildew and age hardening. It shall be mechanically locked, without adhesives, into a formed aluminum helix on the ducts outside surface. It shall be U.L. listed 181 Class 1 and comply with NFPA 90A and 90B. The material shall have a pressure rating not less than 6 inch w.g. positive pressure and -3 inch w.g. negative pressure through a temperature range of -20-degrees F to +250-degrees F.

b. The duct material shall be factory wrapped in a blanket of fiberglass insulation with a C factor of .23 or less. The insulation shall be encased in a fire-retardant reinforced aluminum material vapor barrier with a perm rating of not over .05 grains per square ft. per hour per inch of mercury.

c. Based on Type 5M as manufactured by Flexmaster U.S.A., Inc., ATCO Rubber Products UPC #036 or Omni Air 1200, or Flexible Technologies - Thermaflex M- KF.

G. Ductwork, General: Each duct section shall have both ends covered with polyethylene or other suitable material to protect against the entrance of dirt, debris or water during shipment and storage prior to installation.

H. DUCT SEALANT: Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, used indoors or outdoors. Foster 32-19 Duct Fas, Childers CP-146 Chil Flex or Duro Dyne SAS.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS:

A. Install in strict accordance with the manufacturer's written installation instructions.

B. The drawings, due to their small scale, are diagrammatic in nature and are not necessarily complete in all details. For this reason, not all necessary offsets, rises or falls are shown. Coordinate the installation of the ductwork with all other trades and to provide all necessary offsets, etc. as required for completion of this project without any additional cost to the Owner, Architect or Engineer.

C. All ductworks shall be run parallel or perpendicular to building structure and seams or spirals shall be aligned whenever possible.

D. All sizes indicated on the drawings are inside clear dimensions.

E. All ductworks shall be properly sealed in a neat clean manner with all excess sealer wiped clean.

F. Coordinate the location of, provide the necessary access and install all devices provided in other specification sections within Division 23, including but not limited to fire, smoke and/or balancing dampers, access and mounting for control devices, air flow measuring stations, etc., as apply to this project.

G. All ducts passing through partitions or walls shall be properly and neatly sealed. If partition or wall carries a fire rating (fire damper indicated or if architectural plans indicate a rated wall) the duct shall be sleeved with the space between the sleeve and duct properly sealed with firestopping material (Refer to Division 7 for firestopping material). The sleeve shall be permanently affixed to the wall (see Section 23 05 29 - Supports, Hangers, Anchors and Sleeves for sleeve specification).

H. Coordinate the proper duct pressure classification with the system served and to provide the proper ductwork to withstand these pressures. (See Para. 3.5 Schedules: System Pressure Classification and Duct Material Schedule.)

3.2 CLEANING AND PROTECTION

A. During construction, ductwork shall be cleaned of dirt and debris internally section by section as it is installed. At end of each day, ductwork not finally connected to equipment shall be provided with a temporary closure of polyethylene film or other covering material that will prevent entrance of dust, debris or water. Clean exterior surfaces of any material which might cause corrosion or if the duct is to be painted, it shall be cleaned suitable for painting. After substantial completion of the ductwork system the system shall be operated with filters in place to blow-out any remaining dust from the system. Protect all equipment and property from damage or fouling during this cleaning. All prefilters used during cleaning shall be replaced prior to turning the system over to the Owner.

3.3 LEAK TESTING

A. Duct Leakage Report: The Contractor shall make all the supply, return, outside air, and exhaust duct systems (limited to 1,500 cfm and greater) operationally air-tight, with no more than 2% leakage for duct systems rated at 2 inch w.c. pressure class, and 1% leakage for systems exceeding 2 inch w.c. pressure class. Leakage test to be performed by Contractor with all air device openings and fan connections sealed airtight. Test the systems prior to applying any insulation or concealing in soffits or chases. Use a portable fan capable of producing a static pressure equal or greater than the duct test pressure. This fan to have a flow measuring assembly consisting of a straight section of duct with an orifice plate, pressure taps, and a calibrated performance curve for determining leakage rates.

1. Test each section equal to the external static pressure indicated for that fan or air handler with the portable fan assembly. After the fan achieves that steady state design pressure, record the air flow quantity across the orifice and the percent of design air flow. If the test fails, the Contractor shall reseal and retest at no additional cost to the Owner.
2. Repair all duct leaks that can be heard or felt, even if the system has passed the leakage test.
3. Submit duct leakage reports to the Balancer and the Engineer for their review and approval.
4. Refer to specification section 23 05 93 for more information.

3.4 INSTALLATION

A. General:

1. Install generally as indicated.
2. Conceal ductwork in finished spaces unless indicated otherwise.
3. Do not install ductwork in or allow to enter or pass-through electrical rooms, elevator machine room, or spaces housing switchboards, panelboards, or distribution boards, except ductwork that serves electrical rooms, elevator machine rooms or spaces.

4. Exercise special care to provide tight fitting well fabricated, well braced ductwork systems.
5. Field assemble rectangular, round, or flat oval ductwork as follows:
    a. Use slip joints, couplings, etc. sealed with adhesive pre-applied to couplings or duct mate spiral mate or oval mate on duct sizes 1 inch and larger.
    b. Isolate dissimilar metals with elastomeric sealant tape or fiber gaskets and gaskets and washers for bolts.
6. In high pressure ductwork (above 2 inches w.g.), do not use 2 pieces mitered 90-degree elbows with or without vanes unless approved by engineer.
7. Make duct connections from hoods, openings, fans, and other devices.

B. Double Wall Round Ductwork and Fittings:
1. Coordinate the liner and/or exterior insulation requirements to assure a continuous vapor barrier and uniform thermal resistance. See Para. 3.5 Schedules for liner/insulation thickness requirements.
2. In unconditioned, non-accessible areas such as chases and dry wall ceiling the lined ducts shall also have an additional layer of duct wrap (See Section 23 07 00 -Insulation) at all joints to assure condensation control, wrap will extend a minimum of 6 inches on either side of joint.

C. Uninsulated Round Flexible Ductwork:
1. Provide where indicated or required on return air duct connections only.
2. Maximum length shall be 5'-0".
3. Maximum turn or bend shall be no more than 90-degrees Provide rigid elbows where 90-degrees turns are indicated on the drawings.
4. Flexible ductwork shall be cut to the proper length. Coiling or unnecessary offsets will not be permitted.
5. Secure inner liner to terminal collar or duct coupling with duct sealer and sheet metal screws. Wrap with three wraps of duct tape following helix path.
6. Rigid round ductwork may be substituted in lieu of flex unless the flex duct is used for vibration isolation or otherwise detailed.

D. Insulated Round Flexible Ductwork:
1. Provide where indicated or required on supply air ducts.
2. Coordinate the insulation requirements as to assure a continuous and consistent thermal resistance and vapor barrier.
3. Maximum length shall be 5'-0".
4. Maximum turn or bend shall be no more than 90-degrees Provide rigid elbows where 90-degrees. turns are indicated on the drawings or more than one 90-degrees turn is required.
5. Flexible ductwork shall be cut to the proper length. Coiling or unnecessary offsets will not be permitted.
6. Secure inner liner to terminal collar or duct coupling with duct sealer and sheet metal screws. Provide Stainless steel draw band to seal inner liner tight to connecting duct. Pull insulation over inner liner and fold vapor barrier over end of insulation. Secure with two coats of an approved vapor barrier mastic, reinforced with glass cloth extending 2 inches onto adjacent insulation. One coat of mastic shall be applied to the insulation prior to the application of the glass cloth, which shall be embedded in the mastic to ensure complete adhesion of the cloth.
7. High pressure flexible duct to be provided upstream of all terminal boxes. Low pressure flexible duct may be used downstream of terminal box.

8. Rigid round ductwork may be substituted in lieu of flex unless the flex duct is used for vibration isolation or otherwise detailed. If omitted, external insulation must be provided per Section 23 07 00, “Insulation”.

3.5 SCHEDULES

A. System Pressure Classification and Duct Material Schedule:

System I.D. No.	System	Section	Maximum Pressure	Duct Material
1.	Supply	AHU to Terminal	4" pos.	A
2.	Supply	Terminal to Diffuser	2" pos.	A
3.	Return	Terminal to AHU	2" neg.	A
4.	Emergency Exhaust	Exhaust	See Fan Schedule Legend	

B. Duct Material:

1. Galvanized Steel
2. PVC Coated Galvanized Steel
3. 304 Stainless Steel

C. Access Door Schedule:

Round Ducts:

Duct Size	Access door Size
Up to 7” dia.	12-inch-long removable section
8” to 12” dia.	8 “ x 12”
13” to 18” dia.	12” x 12”
19” and up	14” x 20”

END OF SECTION

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SECTION 23 33 00 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

B. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Duct access doors.

B. Fire doors.

C. Fire dampers.

D. Smoke dampers.

E. Smoke/Fire dampers.

F. Backdraft dampers.

G. Volume dampers.

H. Prefabricated casing panels.

I. Flexible duct connectors.

J. Roof mounted air outlets and inlets.

K. Louver (Exhaust).

L. Louver (Outside Air Intake).

M. Hardware Cloth.

N. Aluminum Brick vent

O. Install miscellaneous control devices.

1.3 QUALITY ASSURANCE

A. All products provided for enhancement of Life Safety shall be UL listed and bear the appropriate label stating compliance.

B. All Products to have a Florida Product Approval Number, as required by the Florida Building Code.

C. All products located in the conditioned air stream or located in return air plenums shall conform to the NFPA 90A Flame/Smoke/Fuel Contribution of 25/50/0 and all other applicable requirements of NFPA 90A.

D. Smoke and Smoke/Fire dampers shall be provided with a 60 month from the date of shipment parts only warranty, including freight for all components, including damper operators.

E. Quality Assurance for Louvers:

1. Source Limitations: Obtain louvers and vents through one source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.
2. Welding: Qualify procedures and personnel according to the following:
    a. AWS D1.2, "Structural Welding Code - Aluminum."
    b. AWS D1.6, "Structural Welding Code - Stainless Steel."
3. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

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SECTION 23 34 00 - HVAC FANS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

B. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. In-line centrifugal fans.

1.3 QUALITY ASSURANCE

A. All electrical components shall be UL listed or labeled.

B. All fans shall be AMCA certified.

C. All components in the conditioned air stream shall conform to the NFPA 90A Flame/Smoke/Fire Contribution Rating of 25/50/0.

D. All electrical devices shall conform to NEMA standards.

E. All Products to have a Florida Product Approval Number, as required by the Florida Building Code.

F. All wiring shall conform to the NEC.

G. Except where special motors are specified or required for the fan duty, all integral horsepower motors to be high efficiency type as specified in Section 23 05 13, “Motors”.

H. The work shall include a one-year warranty from final completion. This warranty shall be by the Contractor to the Owner for any defective workmanship or material which has been furnished at no cost to the Owner for a period of one year from the date of final completion of System. Extended warranty shall be provided for systems installed during earlier phases of construction through to final completion of the final phase. Explain the provisions of warranty to the Owner at the "Demonstration of Completed System" meeting to be scheduled with the Owner upon project completion.

I. Starting of Mechanical Systems:

1. Provide material and labor to perform start-up of each respective item of equipment and system prior to beginning of test, adjust and balance procedures.
2. Provide labor to assist the Owner's Representative in acceptance review.
3. Provide point by point system check-out. Submit results in tabulated form by system. Include this data as part of Operation and Maintenance Manuals.
4. Provide information and assistance and cooperate with test, adjust, and balance services.
5. Comply strictly with manufacturer's recommended procedures in starting up mechanical systems.
6. Provide such periodic continuing adjustment services as necessary to ensure proper functioning of mechanical systems until acceptance and up to 1 full year after date of Owner acceptance.

1.4 SUBMITTALS

A. Submit dimension drawings, performance and product data for acceptance. Include fan curves with the system design point plotted, and second point showing compliance with 110% of design static pressure as required by paragraph 3.1B. Also include fan efficiency and horsepower clearly indicated.

B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

C. Submit in accordance with Division 1 requirements.

D. Submit construction details and dimensional data including weights.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. In-line Centrifugal Fans:

1. Acme Engineering and Manufacturing Corp.
2. Greenheck Fan Corp.
3. Loren Cook Co.
4. Penn Ventilator Co., Inc.

2.2 CONSTRUCTION

A. In-line Centrifugal Fans:

1. Heavy gauge aluminum housing with integral aluminum motor mounting base and straightening vanes heliarc mounted to housing at discharge end. Inlet and outlet flanges.
2. Non-overloading, backwardly inclined aluminum air foil blower wheel with blades heliarc welded to the hub. Dynamically balanced. All wheels keyed to shaft.
3. Belt drive or direct drive as scheduled with motor out of the airstream.
4. Aluminum support bracket. Belt drive units to have locking strap and bolt to permit universal motor position. All motor shall be installed on the bottom of the unit for ease of maintenance.
5. Grease lubricated anti-friction, self-aligning bearings having a minimum average life of 100,000 hours. Extended lubrication tubes.
6. Belt drive units to have adjustable pitch belt drive designed for 140% of motor horsepower with a minimum of two oil resistant non-static belts. OSHA approved motor cover listed below.
7. Direct drive units to be provided with adequate motor cooling passages.
8. Motor Cover: The motor cover completely encloses the motor and drive assembly and also serves as an OSHA belt guard. The cover is constructed of 18-gauge galvanized steel & insulated. This shall be included on all fans with exterior mounted motors and will be factory mounted.
9. Based on Loren Cook Type SQND/SQNB or Greenheck SQ/BSQ.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's installation instructions.

B. Provide fans capable of accommodating static pressure variations of plus 10 percent.

C. Provide matched belts and balanced variable sheaves for motors 15 hp and under, and fixed sheaves for 20 hp and over. Provide belt and sheave changes if required for proper air balancing.

D. Provide belt guards on belt driven fans.

E. Provide safety screen where inlet or outlet is exposed.

F. All fans to have back draft dampers.

G. Provide flexible connections on inlet and outlet of fans connected to ductwork as specified in Section 23 33 00, “Air Duct Accessories”.

END OF SECTION

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SECTION 23 36 00 - AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

B. Refer to Section 23 05 00 for requirements pertaining to Common Work Results for HVAC Systems.

1.2 WORK INCLUDED

A. Single Duct VAV Terminal Units.

B. Electric Heating Coils.

1.3 QUALITY ASSURANCE

A. All units shall be suitable for use in a return air plenum.

B. All components within the air stream shall conform to the NFPA 90A Standard for Flame/Smoke/Fire Contribution of 25/50/0.

C. All units shall be the product of a manufacturer regularly engaged in the production of terminal units and all supplied units shall be clearly described by means of published catalog data from the same manufacturer.

D. All units shall be capable of maintaining their minimum and maximum set points within a maximum of ±5%.

E. Fan powered box insulation and design suitable for 42-degrees F primary air in 75-degrees F, 60% RH ceiling plenum without condensation.

F. Fan powered boxes to be guaranteed to thoroughly mix 42-degrees F primary air with 75-degrees F recirculated air to produce a maximum of 1-1/2-degrees F temperature differential at any place to the duct 4 inches downstream of the unit.

G. Include letter with submittal data stating that unit controls have been completely coordinated with controls contractor.

H. Terminal box manufacturer shall completely coordinate the controls provided on or required by the box with the control package provide under Section 23 09 00, “Instrumentation and Control for HVAC”.

I. The work shall include a one-year warranty from final completion. This warranty shall be by the Contractor to the Owner for any defective workmanship or material which has been furnished at no cost to the Owner for a period of one year from the date of final completion of System. Extended warranty shall be provided for systems installed during earlier phases of construction through to final completion of the final phase. Explain the provisions of warranty to the Owner at the "Demonstration of Completed System" meeting to be scheduled with the Owner upon project completion.

J. Starting of Mechanical Systems:

1. Provide material and labor to perform start-up of each respective item of equipment and system prior to beginning of test, adjust and balance procedures.
2. Provide labor to assist the Owner's Representative in acceptance review.
3. Provide point by point system check-out. Submit results in tabulated form by system. Include this data as part of Operation and Maintenance Manuals.
4. Provide information and assistance and cooperate with test, adjust and balance services.
5. Comply strictly with manufacturer's recommended procedures in starting up mechanical systems.

6. Provide such periodic continuing adjustment services as necessary to ensure proper functioning of mechanical systems until acceptance and up to 1 full year after date of Owner acceptance.

K. Sound Power Data: Manufacturers shall submit sound power data for each comparable size terminal box listed. Sound levels at any speed, at any box, shall not exceed the listings below. The data taken as measured at a distance of one foot from any point on the fan powered box. Based on minimum inlet static pressure +0.5" inch w.g.

	125 Hz	250 Hz	500 Hz	1K	2K	4K
Discharge	73	69	67	64	64	61
Radiated	68	64	57	52	50	44

1.4 SUBMITTALS

A. Submit dimension drawings, performance, and product data for acceptance. Include listing of discharge and radiated sound power level for each of second thru sixth octave band for inlet pressures of 1 inch w.g. Include listing of control air requirements, if applicable.

B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

C. Refer to Division 1 for submittal requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Single Duct VAV Terminal Boxes:

1. Trane
2. Enviro-Tec.
3. E.H. Price Company
4. Krueger
5. Nailor Industries, Inc.
6. Titus
7. Trane
8. Metal*Aire

B. Electric Heating Coils:

1. Enviro-Tec.
2. E.H. Price Company
3. Krueger
4. Nailor Industries, Inc.
5. Titus
6. Metal*Aire

2.2 FABRICATION

A. Single Duct VAV Terminal Units:

1. Unit casing: galvanized steel, fully lined with 1 inch thick, 1-1/2 lb./cu. ft. density, nylon scrim reinforced foil skin vapor barrier insulation. Insulation shall be dual thermal/acoustical fiberglass insulation meeting NFPA 90A requirements and UL 181 erosion control requirements. All cut edges of insulation shall be sealed by a heavy adhesive seal to prevent fibrous material from entering the airstream. A special sheet metal picture frame

bracket shall be used to enclose the liner of the discharge end to prevent the liner from dislodging under extremely high-pressure conditions and to prevent damage during installation. Casing shall have access doors or panels suitable for equipment service. Insulated damper with leakage not to exceed 2% of design flow at 3.0 inch w.g. All joints sealed with adhesive as required. Unit to have air inlet collar and flanged or slip and drive discharge connection.

2. Pressure Independent Air Volume Control Consisting of the Following:
    a. Factory calibrated damper assembly having maximum 4% leakage at 4.0 inch w.g.
    b. Multi-point velocity sensor.
    c. 24V, 40VA control transformer.
    d. Coordinate with DDC control package provided under Section 23 09 00, “Instrumentation and Control for HVAC”.

B. Electric Heating Coil:
1. Tested with the fan terminal in accordance with UL and ETL standards. Meet all NEC requirements. UL Listed.
2. NEMA 1 electrical enclosure with single point connection for heater and fan. Wiring diagram with specific wiring for each unit included with unit.
3. Automatic reset thermal cutouts for each element, nickel chrome heating element, mercury disconnecting contactor for each step of control, line and control terminal blocks, interlocking, disconnect, main supply fuses, positive pressure air flow switch, 24 V control transformer. Coordinate with DDC control package provided under Section 23 09 00, “Instrumentation and Control for HVAC”.
4. Galvanized steel casing with flanged or drive and slip connection.
5. Heating coil integral with terminal unit, and the heating coil shall be internally wired in such a manner that assures that a balanced electrical load will be provided across all three phases of the load at all times.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Install in accordance with manufacturer's written installation instructions.
B. Support terminal box independent of ductwork.
C. Install terminal boxes to provide maximum clearance for electrical and maintenance access.
D. Coordinate the terminal box controls with the building control system contractor to ensure that all miscellaneous accessories required for proper operation are included and that the direct/reverse action normally closed/normally open functions are properly coordinated.
E. If terminal boxes are installed in areas where access to controls thru a lay-in or removable ceiling is not possible, coordinate the locations of access doors thru the ceiling.
F. Be sure minimum and maximum CFM settings agree with the requirements of the terminal unit schedule.
G. Provide rigid metal straight duct equal to four diameters on inlet of all terminals.
H. Provide transitions from duct size to terminal inlet or outlet size as required.
I. Provide flexible duct connection at outlet plus a minimum of 12 inches and a maximum of 36 inches of straight flexible duct upstream of rigid duct at inlet.

END OF SECTION

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SECTION 23 37 13 - GRILLES, REGISTERS AND DIFFUSERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Grilles.

B. Registers.

C. Diffusers.

1.3 QUALITY ASSURANCE

A. Manufacturers shall certify cataloged performance and ensure correct application of all air outlet types.

B. All components within the conditioned air stream or exposed in active or non-active plenums shall conform to the NFPA 90A standard for Flame/Smoke/Fire Contribution of 25/50/0.

C. Manufacturers shall fully comply with LEED IEQ Prerequisite 3 minimum acoustical performance.

1.4 SUBMITTALS

A. Submit schedule and product data for acceptance. Coordinate submittal by "G" number and include construction details, capacity ratings including airside pressure drops and NC levels.

B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

C. Submit in accordance with Division 1 requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Grilles:

1. Titus
2. Anemostat
3. Krueger
4. Metal*Aire Division of Metal Industries, Inc.
5. Nailor
6. Price
7. Trox

B. Registers:

1. Air Concepts
2. Anemostat
3. Krueger
4. Metal*Aire Division of Metal Industries, Inc.
5. Nailor
6. Price
7. Titus

8. Trox

C. Diffusers:
   1. Anemostat
   2. Krueger
   3. Metal*Aire Division of Metal Industries, Inc.
   4. Nailor
   5. Price
   6. Titus
   7. Trox.

2.2 FABRICATION

A. Grilles:
   1. Sidewall or Ceiling Mounted Return/Exhaust Grille:
      a. Construction: Heavy gauge aluminum border. Size as indicated.
      b. Baked enamel finish.
      c. Based on Titus Model 272FL.
   2. Sidewall Double Deflection Supply Grille:
      a. Construction: Aluminum frame with aluminum shaped blades having long blades on front. Size as indicated.
      b. Baked enamel finish.
      c. Based on Titus Model 7DCA-AA.
   3. Ceiling Mounted Return Air Filter Grille:
      a. Construction: Heavy gauge aluminum border. Concealed hinged core with integral filter frame and start-up plus spare filter. Border suitable for use in ceiling specified in Contract Documents. Size as indicated.
      b. Baked enamel finish.
      c. Based on Titus Model 4FL.

B. Registers:
   1. Sidewall or Ceiling Mounted, Return Register (G-5 & G-6):
      a. Construction: Heavy gauge frame and horizontal bars. Bars set at 45-deg fixed deflection. Allen key operated opposed blade damper.
      b. Baked enamel finish.
      c. Based on Titus Model 350FL (aluminum) with/without Model AG-35AA opposed blade aluminum damper (refer to schedule and drawings for requirements).

C. Diffusers:
   1. Square Ceiling Diffuser (G-1):
      a. Construction: Surface or lay-in mounted, 3 cone diffusers. Round collar size as indicated. Aluminum construction only.
      b. Baked enamel finish.
      c. Based on Titus TMS-AA (aluminum).

PART 3 - EXECUTION

3.1 GENERAL

A. Install all devices in strict accordance with the manufacturer's written installation instructions.

B. Coordinate the proper grille style and frame style with the final approved ceiling construction and install grilles, registers, and diffusers in accordance with the requirements of the architectural reflected ceiling plan.

C. Due to the small scale of the drawings the contractor shall assume the responsibility to coordinate the air outlet and inlet locations with the reflected ceiling plans, lighting plans, sections and or details.

D. Any unlined or otherwise exposed parts beyond the grille, register or diffuser face exposed to sight shall be painted black.

E. Coordinate the color requirements for all grilles, registers, and diffusers with the Owner's Representative.

F. Insulate the back pans of all diffusers per the requirements of Specification Section 23 07 00.

G. Air distribution devices installed in lay-in ceilings shall have a 24”x24” extended panel.

H. Devices installed in sheetrock or other hard ceilings shall be surface mount type.

END OF SECTION

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SECTION 23 38 10 - KITCHEN EXHAUST FANS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

B. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Make-up air unit.

B. Exhaust air fan.

C. Roof curb and plenum.

D. Ductwork.

1.3 QUALITY ASSURANCE

A. Underwriters' Laboratories, Inc. regulation UL 710 & UL 762.

B. National Sanitation Foundation Seal of Approval (NSF).

1.4 SUBMITTALS

A. Submit dimension drawings, performance and product data for acceptance. Include fan curves with the system design point plotted, with fan efficiency and horsepower clearly indicated and include computer coil selection clearly indicating system design conditions.

B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

C. Refer to Section 23 05 00 for submittal requirements.

D. Provide Florida Product Approval Numbers for all products required by Florida Building Code (FAC 9N-3).

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Make-up Air Unit:
   1. Grease Master
   2. Cambridge
   3. Loren Cook
   4. Owner approved equal.

B. Exhaust Air Fan:
   1. Grease Master
   2. Cambridge
   3. Loren Cook
   4. Owner approved equal.

C. Roof Curb and Plenum:
   1. Grease Master
   2. Cambridge
   3. Loren Cook
   4. Owner approved equal.

D. Ductwork: Field Fabricated.

2.2 GENERAL

A. The system shall be a complete packaged system.

B. All components shall be furnished by one manufacturer regularly engaged in supplying kitchen exhaust equipment.

2.3 CONSTRUCTION

A. Make-up Air

1. Rooftop, weatherproof construction.
2. Make-up air components shall include:
    a. Housing constructed of heavy gauge galvanized steel with removable access panels.
    b. Rain hood with bird screen.
    c. Filter section with 1 inch cleanable filters. Provide extra set of filters.
    d. Fan section with belt driven forward curved DWDI fan constructed of heavy gauge steel, statically and dynamically balanced. Fan shall be capable of supplying the required CFM as indicated on the drawings. The fan shaft shall be ground and polished steel mounted in heavy duty, sealed ball bearings. bearings shall be selected for a minimum average (L50) life in excess of 200,000 hours at maximum cataloged operating speeds. Pulleys shall be of the fully machined, cast iron type, keyed and securely attached to the wheel and motor shafts. Motor sheaves shall be adjustable for final system balancing. Drives shall be sized for a minimum of 150% of driven horsepower.
    e. Motors shall comply with Specification Section 23 05 13.
    f. Support legs.
    g. Control package including master disconnect switch, fuses, magnetic motor starters with thermal overloads and single-phase protection as specified in Section 23 05 13 for Motor Starters, interlocks, and wiring necessary to interlock with the exhaust fan, canopy mounted controls.
    h. Based on Loren Cook Model KSP.
3. EHPA Additional Requirements:
    a. All tie downs per the Florida Building Code.
    b. Hurricane rated construction (Miami-Dade County, FL NOA 08-0904.04 / 11-13-2013).
    c. TAS-201, TAS-202, TAS-203 & Florida product approvals.
    d. Based on Loren Cook Model ASP.

B. Exhaust Air Unit:

1. General:
    a. Up blast type construction of spun aluminum.
    b. Built in grease trough.
    c. Welded drain plug.
    d. Prewired disconnect NEMA 3R.
    e. Isolated motor compartment with disconnect.
    f. Provide stainless steel container, minimum of 1 gallon to collect grease run-off from built in grease trough. Container shall be mounted to avoid accidental tip over.
    g. Fan section with belt driven BI fan constructed of aluminum with aluminum wheel. Fan shall be capable of supplying the required CFM as indicated on the drawings. The fan shaft shall be ground, and polished steel mounted in heavy duty, sealed ball bearings.

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Bearings shall be selected for a minimum average (L50) life in excess of 200,000 hours at maximum cataloged operating speeds. Pulleys shall be of the fully machined, cast iron type, keyed, and securely attached to the wheel and motor shafts. Motor sheaves shall be adjustable for final system balancing. Drives shall be sized for a minimum of 150% of driven horsepower.

h. Fan to be UL labeled for grease duct use.

i. Based on Loren Cook Model VCR-HP.

i. EHPA Additional Requirements:

a) All tie downs per the Florida Building Code.

b) Hurricane rated construction (Miami-Dade County, FL NOA 08-0904.04 / 11-13-2013).

c) TAS-201, TAS-202, TAS-203 & Florida product approvals.

d) Based on Loren Cook Model VCR-HP.

C. Roof Curb, Hinged Sub-Base and Plenum:

1. Constructed of 18-gauge zinc coated steel, minimum height 18 inches.
2. Curb and plenum to facilitate the mounting of the exhaust fan and connection of the supply duct.
3. Continuously welded corners.
4. 3 lb. density and acoustical insulation.
5. Curb to be self-flashing with cant strip.
6. Exhaust and supply fans to have roof curb typical to a Loren Cook RCG.
7. Exhaust fan to have hinged sub-base typical to a Loren Cook 30T.

D. Ductwork:

1. Exhaust Ductwork:
   a. Constructed of 16-gauge 304 stainless steel.
   b. All welded construction.
   c. Access door at offsets for cleaning.
   d. Refer to Section 23 31 01, “Shop Fabricated Ductwork” for additional requirements.
2. Supply Ductwork:
   a. Constructed of galvanized steel in accordance with SMACNA requirements.
   b. Duct seams constructed to keep water out on ducts exposed on roof.
   c. Refer to Section 23 31 01, “Shop Fabricated Ductwork” for additional requirements.
3. Duct system, supply and exhaust may be run parallel or as a duct within a duct type assembly.
4. Where applicable, construct a balanced "pair of pants" type connection to connect the two halves of an island canopy.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install items in accordance with manufacturers printed instructions.

END OF SECTION

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SECTION 23 41 00 - PARTICULATE AIR FILTRATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

B. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Extended Surface, Pleated, Panel Type Filters.

B. Filter Gauges

1.3 QUALITY ASSURANCE

A. High efficiency filter to be rated as per ASHRAE Standard 52-76 (atmospheric dust). The manufacturer shall guarantee filter performance to be as stated in their literature within tolerances conforming to Section 7.4 of ARI Standard 850-78. Representative filters shall have been tested by an independent, commercially operated test laboratory. The independent test laboratory report shall be available upon request to the specifying engineer and/or Owner.

B. Filter testing to be in accordance with UL Standard 900.

1.4 SUBMITTALS

A. Submission for acceptance is not required.

B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

C. Submit in accordance with Division 1 requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Extended Surface, Pleated, Panel Type Filters:

1. American Air Filter
2. Camfil-Farr
3. Purolator Products Air Filtration Co.
4. Flanders Filters, Inc.

B. Filter Gauges

1. Dwyer Instruments, Inc.
2. Approved Equal.

2.2 FABRICATION

A. Extended Surface, Pleated, Panel Type Filters:

1. Extended surface pleated, cotton/synthetic fiber media, cardboard frame, wire support grid, dry type.
2. Dry filtering principal.
3. 2" thick, 30% minimum efficiency, UL Class 2 approved, maximum face velocity 500 FPM for construction filters and 2” thick, 90% minimum efficiency, UL Class 2 approved, maximum face velocity 500 FPM for post construction filters.
4. Initial maximum air friction at 500 FPM equals .30 w.g. Air friction at change-out equals 1.00" w.g.

5. Air filtration efficiency shall be MERV8 (construction phase) & MERV13 (post construction phase) and have 150 grams of dust holding capacity when tested in accordance with ASHRAE 52.2 & 52.1 respectively.
6. Based on AAF Perfect Pleat HC-M8 construction and AAF AMAir 1300 post construction occupancy.

B. Filter Gauges:

1. Dry type gauge with appropriate pressure range for "final" pressure listed in schedule.
2. Include static tips, compression fittings, 1/4 inch aluminum tubing and plastic vent valves.
3. Based on Dwyer Magnahelic 2000 Series.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Install filters and filter gauges in strict accordance with manufacturer’s recommendations. Provide separate gauge tap and valving so that pressure drop can be measured individually across final filters.

B. MERV8 construction filters to be removed from grilles and air handling units prior to occupancy and not replaced at the grilles. Final MERV13 filters shall be installed at the air handling units prior to occupancy and shall be replaced by the contractor after the commissioning process has been approved by the commissioning agent, owner and engineer.

C. Contractor to pay particular attention to prevent air bypass through filter support system.

D. Do not operate fan systems without filters in place.

E. Provide six extra sets of final MERV13 filters for all air handling units.

END OF SECTION

SECTION 23 44 00 - AIR PURIFICATION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. This section describes the design, performance and installation of an air purification system intended for use as part of another manufacturer’s air handling unit or mounted on the duct as shown on the plans, details and equipment schedules.

B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

C. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 REFERENCED CODES & STANDARDS

A. The following codes and standards are referenced throughout. The edition to be used is that currently enforced by the authority having jurisdiction (AHJ) or in absence of such direction that referenced by the current enforceable IBC code or as indicated by the contract documents, except where specifically referenced by this section of the specifications.

1. ASHRAE Standards 62 & 52
2. National Electric Code NFPA 70
3. UL 867 including ozone chamber test required as of December 21, 2007
4. The ionization equipment and power supply shall be UL and CE listed.

1.3 RELATED WORK

A. Testing, Adjusting and Balancing

B. Facility Access and Protection

C. Ductwork

D. Filters

E. Water and Refrigerant Piping

F. Electrical Wiring

G. Control Wiring

1.4 QUALITY ASSURANCE

A. Basis of design is Global Plasma Solutions. Airgenics and Bio-Oxygen shall be considered equal subject to meeting ALL specifications herein. All other manufacturers requesting prior approval must submit product drawings, specifications and test results specified in section 2.2 at least four weeks prior to bid date.

B. The Air Purification System shall be a product of an established manufacturer within the USA and shall be made of 100% USA sourced raw materials and components.

C. A qualified representative from the manufacturer shall be available to inspect the installation of the air purification system to ensure installation in accordance with manufacturer's recommendation.

D. Technologies that do not address gas disassociation such as UV Lights, Powered Particulate Filters and/or polarized media filters shall not be considered. Uni-polar ion generators shall not be acceptable. “Plasma” particulate filters shall not be acceptable.

E. Projects designed using ASHRAE Standard 62, IAQ Procedure shall require the manufacturer to provide Indoor Air Quality calculations using the formulas within ASHRAE Standard 62.1-2007 to validate acceptable indoor air quality at the quantity of outside air scheduled with the technology submitted. The manufacturer shall provide independent test data on a previous installation performed within the last two years and in a similar application, that proves compliance to ASHRAE 62 and the accuracy of the calculations.

F. The Air Purification Technology shall have been tested by UL or Intertek/ETL to prove conformance to UL 867-2007 including the ozone chamber testing and peak ozone test for electronic devices. Manufacturers that achieved UL 867 prior to December 21, 2007 and have not been tested in accordance with the newest UL 867 standard with the ozone amendment shall not be acceptable. All manufacturers shall submit their independent UL 867 test data with ozone results to the engineer during the submittal process. All manufacturers shall submit a copy with their quotation. Contractors shall not accept any proposal without the proper ozone testing documentation.

G. The maximum allowable ozone concentration per the UL 867-2007 chamber test shall be 0.007 PPM. The maximum peak ozone concentration per the UL 867-2007 peak test as measured 2 inches away from the electronic air cleaner's output shall be no more than 0.0042 PPM. Manufacturers with ozone output exceeding these ozone values shall not be acceptable.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for ion generators including:

1. Schedule of plasma generators indicating unit designation, number of each type required for each unit/application.
2. Data sheet for each type of plasma generator, plasma detector and accessory furnished, indicating construction, sizes, and mounting details.
3. Performance data for each type of plasma device furnished.
4. Indoor Air Quality calculations using the formulas within ASHRAE Standard 62.1-2007 to validate acceptable indoor air quality at the quantity of outside air Scheduled (when projects are designed with outside air reduction).
5. Product drawings detailing all physical, electrical and control requirements.
6. Copy of UL 867 independent ozone test.

B. Operating & Maintenance Data: Submit O&M data and recommended spare parts lists.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver in factory fabricated shipping containers. Identify on outside of container type of product and location to be installed. Avoid crushing or bending.

B. Store in original cartons and protect from weather and construction work traffic.

C. Store indoors and in accordance with the manufacturers' recommendation for storage.

1.7 WARRANTY

A. Equipment shall be warranted by the manufacturer against defects in material and workmanship for a period of eighteen months after shipment or twelve months from owner acceptance, whichever occurs first. Labor to replace equipment under warranty shall be provided by the owner or installing contractor.

PART 2 - PRODUCTS

2.1 GENERAL

A. The air purification system(s) shall be of the size, type, arrangement and capacity indicated and required by the unit furnished and shall be of the manufacturer specified.

B. Basis of Design: Global Plasma Solutions

C. All other Suppliers of comparable products requesting prior approval shall:

1. Submit for prior approval four weeks in advance in accordance with the requirements of Section 23 05 00.
2. In addition, manufacturers submitting for prior approval for Bi-Polar Ionization must as part of the prior approval request provide their ASHRAE 62.1-2007 calculations that prove conformance to the ASHRAE Standard with the reduction of outside air to the scheduled

values. A letter on the manufacturer's letterhead requesting prior approval must accompany the request for prior approval stating their calculations are ASHRAE compliant. A third-party validation study performed on a previous installation of the same application shall also be included.

3. Submit independent test data from ETL or UL showing ozone levels produced during the UL 867 ozone chamber test. Manufacturers without this test data shall not be acceptable.
4. Submit pathogen testing per section 2.2.
5. Submit at least two other end user references in the same application with contact phone number, email, equipment used and application for the equipment at that facility. Manufacturers not having the above references in similar applications using the same equipment models as proposed on the current project shall not be acceptable.

2.2 BI-POLAR IONIZATION DESIGN & PERFORMANCE CRITERIA

A. Each piece of air handling equipment, so designated on the plans, details, equipment schedules and/or specifications shall contain a Plasma Generator with Bi-polar Ionization output as described here within.

B. The Bi-polar Ionization system shall be capable of:

1. Effectively killing microorganisms downstream of the bi-polar ionization equipment (mold, bacteria, virus, etc.).
2. Controlling gas phase contaminants generated from human occupants, building structure, furnishings, and outside air contaminants.
3. Capable of reducing static space charges.
4. Effectively reducing space particle counts.
5. When mounted to the air entering side of a cooling coil, keep the cooling coil free from pathogen and mold growth.
6. All manufacturers shall provide documentation by an independent NELEC accredited laboratory that proves the product has minimum kill rates for the following pathogens given the allotted time and in a space condition:
    a. MRSA - >96% in 30 minutes or less
    b. E.coli - > 99% in 15 minutes or less
    c. TB - > 69% in 60 minutes or less
    d. diff - >86% in 30 minutes or less
    e. Manufacturers not providing the equivalent space kill rates shall not be acceptable. All manufactures requesting prior approval shall provide to the engineer independent test data from a NELEC accredited independent lab confirming kill rates and time meeting the minimum requirements stated in section 2.2 B, points 6A, 6B and 6C. Products tested only on Petri dishes to prove kill rates shall not be acceptable. Products being sold under different trade names than those tested shall not be acceptable.

C. The bi-polar ionization system shall operate in a manner such that equal amounts of positive and negative ions are produced. Uni-polar ion devices shall not be acceptable.

1. Air exchange rates may vary through the full operating range of a constant volume or VAV system. The quantity of air exchange shall not be increased due to requirements of the air purification system.
2. Velocity Profile: The air purification device shall not have maximum velocity profile.

D. Humidity: Plasma Generators shall not require preheat protection when the relative humidity of the entering air exceeds 85%. Relative humidity from 0 - 100%, condensing, shall not cause damage, deterioration, or dangerous conditions within the air purification system. Air purification system shall be capable of wash down duty.

E. Equipment Requirements:

1. Electrode Specifications (Bi-polar Ionization):

a. Each Plasma Generator with Bi-polar Ionization output shall include the required number of electrodes and power generators sized to the air handling equipment capacity. A minimum of sixteen 316 medical grade stainless steel ion needles per foot of coil face width shall be provided. The entire cooling coil width shall have equal distribution of ionization across the face. The plasma electrode shall require no more than one inch in the direction of airflow for mounting. All hardware required for mounting shall be provided by the air handler unit manufacturer. Bi-polar ionization tubes manufactured of glass and steel mesh shall not be acceptable due to replacement requirements, maintenance, and performance output reduction over time, ozone production and corrosion. Plasma generators with recessed needles shall not be acceptable.

b. Electrodes shall be energized when the main unit disconnect is turned on and the fan is operating.

F. Air Handler Mounted Units:

1. Where so indicated on the plans and/or schedules Plasma Generator(s) shall be supplied and installed. The mechanical contractor shall mount the Plasma Generator and wire it to the remote mount power supply using the high voltage cables provided by the air purification manufacturer. An 115VAC or 230VAC circuit shall be provided to the ion generator power supply panel. Each ion generator shall be designed with an aluminum casing, integral grounding connection and high voltage quick connector.

G. Ionization Requirements:

1. Plasma Generators with Bi-polar ionization output shall be capable of controlling gas phase contaminants and shall be provided for all equipment listed above.

a. The Bi-polar ionization system shall consist of Bi-Polar Plasma Generator and power supply. The Bi-polar system shall be installed where indicated on the plans or specified to be installed. The device shall be capable of being powered by 115VAC or 230VAC without the use of an external transformer. Ionization systems requiring isolation transformers shall not be acceptable.

b. Ionization Output: The ionization output shall be controlled such that an equal number of positive and negative ions are produced. Imbalanced levels shall not be acceptable.

c. Ionization output from each electrode shall be a minimum of 20 million ions/cc when tested at 2” from the ionization generator.

2. Ozone Generation:

a. The operation of the electrodes or Bi-polar ionization units shall conform to UL 867-2007 with respect to ozone generation.

H. Electrical Requirements:

1. Wiring, conduit and junction boxes shall be installed within housing plenums in accordance with NEC NFPA 70. Plasma Generator shall accept an electrical service of 115 VAC or 230VAC, 1 phase, 50/60 Hz. The contractor shall coordinate electrical requirements with air purification manufacturer during submittals.

I. Control Requirements:

1. All Plasma Generators shall have internal short circuit protection, overload protection, and automatic fault reset.

2. The ionization system shall be provided with a stand-alone, independent ion sensor designed for duct mounting to monitor the ion output and report to the BAS system that the ion device is working properly. Ion systems provided without an independent ion sensor, shall not be permitted. The control voltage to power the ion sensor shall be 12VDC, 24VDC or 24VAC

and draw no more than 150mA of current. The sensor shall provide at minimum, dry contact status to the BAS and optionally a BacNet or Lon Works interface as specified on the control drawings.

3. The installing contractor shall mount and wire the Plasma device within the air handling unit specified or as shown or the plans. The contractor shall follow all manufacturer IOM instructions during installation.

2.3 PLASMA DETECTOR DESIGN & PERFORMANCE CRITERIA

A. Each piece of air handling equipment, so designated on the plans, details, equipment schedules and/or specifications shall contain a Plasma Detector with integral BAS contacts.

B. The Plasma Detector sensor shall be designed to these minimum standards:

1. Ability to detect both positive and negative ion levels from 1,000 ions/cc to 20 million ions/cc minimum. Detection limit shall be field adjustable based on sensor mounting location and manufacturer being sensed.

2. Plasma detector shall have integral dry alarm contacts for connection to the BAS to prove the ion system is operating properly and the ion system output is above the minimum preset threshold from the sensor manufacturer. The alarm shall activate when either positive or negative ion output drops below the preset setpoint. Cold plasma systems only providing indication the input power is applied or output power is present shall not be acceptable. The independent cold plasma detector shall be capable of working with any air purification manufacturer's system.

3. Cold plasma detector shall have an input voltage of 12VDC, 24VDC or 24VAC user selectable.

4. Cold plasma detector shall be capable of duct mounting or integral airstream mounting.

5. Housing shall be constructed of fire-retardant ABS plastic.

6. Temperature and humidity shall have no effect on the cold plasma detector output accuracy.

7. The alarm output shall be provided with NO, NC and C terminals for ease of integration to the BAS. The contacts shall be rated for up to 5 amps at 230VAC or up to 24VDC at 2 amps.

8. An optional BACnet or Lon Works control interface shall be provided as required if so, indicated on the master schedule and provided by the cold plasma detector manufacturer.

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor shall be responsible for maintaining all air systems until the owner accepts the building (Owner Acceptance).

3.2 ASSEMBLY & ERECTION: PLASMA GENERATOR WITH BI-POLAR IONIZATION & COLD PLASMA DETECTOR

A. All equipment shall be assembled and installed in a workman like manner to the satisfaction of the owner, architect, and engineer.

B. Any material damaged by handling, water or moisture shall be replaced by the mechanical contractor, at no cost to the owner.

C. All equipment shall be protected from dust and damage on a daily basis throughout construction.

3.3 TESTING

A. Provide the manufacturers recommended electrical tests.

3.4 COMMISSIONING & TRAINING

A. A manufacturer's authorized representative shall provide start-up supervision and training of owner's personnel in the proper operation and maintenance of all equipment.

END OF SECTION

SECTION 23 64 16 - WATER-COOLED CENTRIFUGAL WATER CHILLERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Semi-hermetic, water-cooled, direct-drive centrifugal chillers that shall use HFO-514A.

1.2 SUBMITTALS

A. Acceptable refrigerants on which chiller performance is based are HFO-514A and HFO-513A. All proposals for chiller performance must include an AHRI approved selection method for the specified refrigerants.
B. Submit drawings indicating assembled dimensions, operating weight, load distribution, and required service and access clearances.
C. Submit product data indicating options and specialties, electrical requirements, wiring diagrams and connections. Indicate accessories, valves, strainers, and thermostatic valves required for the complete system.
D. Submit rigging, installation, and startup procedures. Include operations and maintenance data for both the chiller and starter or variable-speed drive. Include location, size, and type of field piping connections.
E. Submit performance data indicating energy input versus cooling load output from 100 to 25 percent of full load with constant entering condenser water temperature.
F. Submit compressor and product data in table form indicating impeller speed (RPM), number of bearings, type of bearings, high speed impeller shaft RPM, sound pressure level per AHRI 575-2008 (dB), number of stages, number of sets of inlet guide vanes, amount of refrigerant charge (lb.), and amount of oil required (gal).

1.3 REGULATORY REQUIREMENTS

A. Conform to AHRI Standard 550/590 code for rating and testing of water chillers.
B. Conform to UL 1995 for Safety for Heating and Cooling Equipment.
C. Conform to ANSI/ASME SECTION VIII Boiler and Pressure Vessel Code for construction and testing of centrifugal chillers as applicable.
D. Conform to latest revision of ANSI/ASHRAE STANDARD 15 codes for construction and operation of centrifugal chillers.
E. Unit shall bear the AHRI Certification Label for the specific type of water chiller as applicable.
F. Chiller must ship with low-GWP, next generation refrigerant such as R-513A or R-514A.

1.4 DELIVERY, STORAGE, HANDLING AND EQUIPMENT ROOM REQUIREMENTS

A. Comply with manufacturer's installation instructions for rigging, chiller loading, local transportation requirements, unloading, storage, and final setting.
B. Protect chiller and controls from physical damage. Leave factory shipping covers in place until installation. The entire unit must be shrink wrapped with an environmentally recyclable material standard. The material shall include an imbedded desiccant to minimize/eliminate internal moisture.
C. The chiller shall ship with a dry nitrogen charge to eliminate potential charge loss during delivery and construction. The refrigerant must be shipped separately from the chiller. The refrigerant monitoring system shall be active at the job site prior to the charging of the chiller.
D. The chiller should ship with a full charge of oil.
E. Equipment Room Requirements
    1. Follow minimum standards for refrigeration systems as required by the latest revision of ANSI/ASHRAE Standard 15, paying special attention to requirements for air monitoring, ventilation, self-contained breathing apparatus, and leak detection to assure the safety of chiller plant operating personnel.
    2. Install proper outside exhaust of chiller refrigerant relief device(s), discharge header(s), and purge unit(s). Route exhaust to the outside of the building and away

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from all air intake in compliance with the latest revision of ANSI/ASHRAE Standard 15.

3. Per ASHRAE Standard 147, medium pressure units with relief valves only shall have rupture discs in series with relief valves to minimize refrigerant leakage.
4. Field-install as required a refrigerant monitor that can be calibrated for appropriate refrigerant(s), capable of detecting concentrations of minimum ppm for low-level leak detection to assure the safety of chiller plant operating personnel.
5. Field-install as required suitable audible and visual alarms that activate well below the Acceptable Exposure Level (AEL) of the specific refrigerant(s) to alert persons inside and outside of the equipment room that a refrigerant leak condition exists.
6. Storage: Per ASHRAE Standard 147, positive pressure units must have a pump down capability that isolates the refrigerant charge for storage in a suitable vessel. If pump down capability does not exist, then the charge must be removed during long idle periods.

1.5 WARRANTY

A. Provide standard unit parts and labor warranty for one year from startup or 18 months from shipment, whichever occurs first.
B. Beginning at the expiration of the standard warranty, the original equipment owner shall be provided optional extended warranties.
   1. These warranties shall include:
      a. Whole unit parts for Years 2 to 5.
      b. Whole unit labor for Years 2 to 5.
      c. Refrigerant quality for Years 2 to 5.
   2. See extended warranties for additional warranty details.
C. Leak Tight Warranty: Provide as part of the chiller scope a refrigerant loss warranty for less of 60 months from initial start-up or 66 months from date of shipment. During this period, the manufacturer shall furnish replacement refrigerant which is lost due to a leak in the machine. Once a leak is determined, action must be taken (acceptable to the manufacturer) to eliminate the source of the leak. Replacement parts and labor are not covered under this warranty. If the chiller is placed under a comprehensive service and maintenance agreement from the original equipment manufacturer prior to the expiration of the standard refrigerant loss warranty, the refrigerant loss coverage shall continue as long as an active service and maintenance agreement from the manufacturer remains in effect without interruption.

1.6 MAINTENANCE SERVICES

A. All inspections and service of units shall be accomplished by factory trained and authorized servicing technicians.
B. All labor for leak checking the chiller according to the manufacturer's IOM and documentation must be included.
C. In conjunction with and supporting Factory warranty OEM shall furnish complete factory authorized service and maintenance for applied chillers for 1 year from the Date of Substantial Completion. All work shall be done by the manufacturer’s commercial warranty agent.
D. OEM shall provide and report quarterly, semiannual, and annual maintenance in compliance with or better than ASHRAE Standard 180-2008.
E. Include maintenance items as recommended in manufacturer's operating and maintenance data.
F. Submit a copy of service call work orders and summary report to the owner, including description of work performed, operating performance status and noted exceptions.

1.7 VERIFICATION OF CAPACITY AND EFFICIENCY

A. PERFORMANCE TOLERANCES
   1. The following allowable tolerances must be followed:
      a. The tolerance on allowable capacity must be as defined by AHRI Standard 550/590.
      b. The IPLV/NPLV and full load tolerances are as defined by AHRI Standard 550/590, and the tolerances at full load and all part load test points must also be as defined by AHRI Standard 550/590 if applicable.

PART 2 - PRODUCTS

2.1 SUMMARY

A. Description: Factory-assembled and tested water chiller complete with compressor, evaporator, condenser, controls, starter or variable frequency drive, interconnecting unit piping and wiring, indicating accessories, and mounting frame.
B. The contractor shall furnish and install centrifugal water chillers as shown and scheduled in the plans and specifications. The units shall produce the specified tonnage per scheduled data in accordance with the latest revision of AHRI 550/590. The unit shall bear the AHRI certification label as applicable.
C. Unit shall be painted in accordance with the manufacturer's standard procedures and practices.

2.2 APPROVED MANUFACTURERS

A. Base bid shall be Trane model RTHD chiller with low GWP refrigerant. Project award shall be based on basis of design chiller.
B. Alternate low-pressure chillers manufactured by JCI and Carrier that meet scheduled performance (tonnage, full load efficiency, and NPLV at design conditions) may be analyzed for submission post project award.
C. The awarded Chiller manufacturer must provide with the Chiller submittal a copy of this specification section (23 64 16) and the applicable equipment schedule indicating on a line-by-line basis “Comply With,” “Deviate From,” or “Take Exception To”.
   1. If the schedule line item or specification note is indicated as “Deviate From” or “Take Exception To”, chiller manufacturer must provide a detailed explanation of the difference, the reason for the difference, and how the proposed product meets the intent of the design.
   2. Failure to provide this “Comply With”, “Deviate From”, or “Take Exception To” review of all specification items and schedule information will result in a rejected submittal.

2.3 COMPRESSOR AND MOTOR

A. The compressor shall be centrifugal with single or multiple stages.
B. Low pressure refrigerant must be provided.
C. Chiller should be able to unload to 10.00 % of design tonnage with constant 85-degree F entering condenser water temperature. The minimum unloading point shall be able to be demonstrated if a factory performance test is required.
D. Compressor assembly shall be vibration tested at the factory. Vibration shall not exceed 0.15 inches per second at full load design compressor speed as measured on the motor housing. The test data shall be recorded and provided to the customer for approval.
E. The motor shall be hermetic and either suction or liquid refrigerant cooled. Hot gas motor cooling is not acceptable.
F. If an open motor design is used, then the manufacturer shall provide and install a complete chilled water air handling unit (AHU) with a capacity equal to 0.9% of the chiller's tonnage to serve the chiller area, which must be completely operational and include all wiring and automatic temperature controls. The open motor chiller manufacturer must also increase chiller size by an equivalent tonnage with no increase in specified full load kW, and shall list, on the submittal, additional maintenance requirements due to alignment, refrigerant shaft seal, coupling and bearings. Additionally, if an open drive motor is provided, a motor-

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compressor shaft seal leakage containment system shall be provided with the following inclusions:

1. An oil reservoir shall collect any oil and refrigerant that leaks past the seal.
2. A float device shall be provided to open when the reservoir is full, directing the refrigerant/oil mixture back into the compressor housing.
3. Manufacturer shall warrant the shaft seal, reservoir, and float valve system against leakage of oil and refrigerant to the outside of the chiller for a period of 10 years from initial start-up, including parts and labor to replace a defective seal and any refrigerant required to trim the charge to original specifications. Inspections shall be performed a minimum of once a year. See Section 1.05 for more information about the warranty.

G. Motors shall have winding 100 ohm platinum RTDs for temperature sensing on each phase. Thermistors and thermal overloads are not acceptable. These temperatures shall be furnished to the unit control panel for monitoring and alarm.

H. Manufacturers with speed increasing transmissions shall not exceed 10,000 RPM compressor speeds and shall annually inspect the gears and all bearings. A report shall be forwarded to the owner each year over the first five years to confirm completion.

I. If the manufacturer uses electronic (i.e., magnetic) bearings, a 10-year warranty on all chiller compressor capacitors must be provided.

J. The impellers shall be fully shrouded and made of a high strength aluminum alloy. Impellers shall be dynamically balanced and over-speed tested at 1.25 times impeller shaft speed.

2.4 EVAPORATOR (CHILLER BARREL)

A. The evaporator and condenser shall be built in accordance with ANSI/ASHRAE 15-2001 Safety Code for Mechanical Refrigeration and ASME section VIII as applicable.

B. Evaporator tubes shall be internally and externally enhanced with a 1.00" outer diameter. The tubes shall be securely supported at intermediate supports and physically expanded into both ends of the tube sheets. The evaporator tubes must also be removable from both ends to provide easy access for tube cleaning.

1. The minimum evaporator tube wall thickness, root-to-root across the entire tube length shall be 0.025". It is unacceptable to provide this thickness at the intermediate supports only.

C. The evaporator water piping connections shall be grooved.

D. The evaporator waterboxes (if specified) shall be standard non-marine type with connections per the schedule.

E. Supply and return head waterboxes (if specified) shall be designed for a working pressure of 150 psi and shall be factory hydrostatic pressure tested at 150 percent of the design pressure. Provide drain and vent connections in water boxes.

F. No unit insulation is required at the time the chiller is shipped from the factory. Insulation to be provided in the field and carried in the contractor’s bid.

G. Units with multi-stage compressors shall incorporate an interstage flash vessel "economizer". All units with single stage compressors shall have the condensers circuited for liquid subcooling and be provided with a thermometer well to monitor the amount of subcooling.

H. Adjustable or float type refrigerant metering devices and thermal expansion valves shall be inspected and adjusted by the manufacturer at the end of each year for the first five years of operation to assure equivalent reliability and maintenance to a fixed orifice system. A written report shall be forwarded to the owner each year to confirm completion.

2.5 CONDENSER

A. The condenser shall be built in accordance with ANSI/ASHRAE 15-2001 Safety Code for Mechanical Refrigeration and ASME section VIII as applicable.

B. Condenser tubes shall be internally and externally enhanced with a 0.75" outer diameter. The tubes shall be securely supported at intermediate supports and physically expanded

into both ends. The condenser tubes must also be removable from both ends to provide easy access for tube changeouts or tube cleaning.

1. The minimum condenser tube wall thickness, root-to-root across the entire tube length shall be 0.028". It is unacceptable to provide this thickness at the intermediate supports only. Tube wall thickness cannot be measured from the peak of the tube enhancements.

C. The condenser water piping connections shall be grooved.

D. The condenser waterboxes (if specified) shall be standard non-marine type with connections per schedule.

E. Supply and return head waterboxes (if specified) shall be designed for a working pressure of 150 psi and shall be factory hydrostatic pressure tested at 150 percent of the design pressure. Provide drain and vent connections in waterboxes (if specified).

2.6 REFRIGERANT

A. Acceptable Refrigerants on which chiller performance is based are low-GWP, next generation refrigerants such as R-513A, R-514A, or R-1233zd(E), or Engineer approved.

B. Refrigeration Transfer: Provide service valves and other factory-installed accessories required to facilitate transfer of refrigerant from the chiller to remote systems.

1. See Section 1.04 for additional details on refrigerant shipment.

C. Refrigerant Flow Control: Fixed orifice plates at the entrance and exit of the economizer shall be used to control refrigerant flow.

D. Low pressure chillers: Chillers that operate at low pressures must have a high efficiency purge system to ensure that any potential non-condensable leakage into the vessel is immediately eliminated. The purge run time shall be monitored by the main unit controller to act as a leak detector if required, and must have the following specifications:

1. The manufacturers of low-pressure machines must provide a purge system.
2. Purge efficiency must meet ASHRAE Standard 147-2002.
3. The purge shall be capable of operating when the chiller is idle in accordance with ASHRAE Standard 147-2002.

2.7 ELECTRICAL

A. Chiller shall be installed, wired, and functionally tested at the factory before being shipped.

B. Single point power connection - A control power transformer internal to the motor controller/frequency drive and of sufficient size to power all chiller mounted auxiliary loads shall be supplied. No separate power connection shall be required for chiller mounted equipment. The CPT shall tap from the main power connection.

C. Terminal blocks are numbered to match the wiring diagram must be included.

2.8 CONTROLS

A. The chiller shall be controlled by a unit mounted, stand-alone Direct Digital Control (DDC) system. A dedicated chiller microprocessor control panel is to be supplied with each chiller by the chiller manufacturer.

B. Enclosure shall be unit mounted NEMA 250 Type 1.

C. The chiller manufacturer shall include a pressure, non-mechanical based flow switch that is of thermal dispersion type for each evaporator and condenser to verify flow through the unit.

D. A color, touch sensitive liquid crystal display (LCD) shall be unit mounted and a minimum of 12.1" diagonal. The display shall be fully adjustable in height and viewing angle. Animated graphical representations of chiller subsystem operation shall be used to enhance the user interface.

E. Display shall consist of a menu driven interface with easy touch screen navigation to organized sub-system reports for compressor, evaporator, condenser, purge, and motor information as well as associated diagnostics. The controller shall display all active diagnostics and a minimum of 20 historical diagnostics.

F. The chiller control panel shall provide control of chiller operation and monitoring of chiller modules, sensors, actuators, relays, and switches. The chiller control panel shall include controls to operate the chiller safely and efficiently.
G. Control authority must be capable of handling at least four conditions: Off, local manual at the chiller, local automatic at the chiller and automatic control through a remote source.
H. Capability to connect a laptop to service utility with applicable software from manufacturer and obtain enhanced set-up and diagnostics.
I. Chiller controls shall use entering evaporator water temperature readings to anticipate and compensate for changes in the chiller's operating conditions.
    1. Shall allow control of the leaving chilled water temperature to within +/- 1.0 F at a water flow rate change of 10% per minute and will stay online at a water flow rate change of 30% per minute.
J. Chiller controls shall unload chiller automatically to prevent it from exceeding its limits and to keep the chiller online under the following conditions:
    1. The condenser pressure is at or near the high condenser limit setting.
    2. The saturated evaporator temperature is at or near the low refrigerant temperature cutout setting.
K. The front of the chiller control panel shall display the following in clear language, without the use of codes, look-up tables, or gauges:
    1. Run time.
    2. Number of starts.
    3. Current chiller operating mode.
    4. Chilled water set point and set point source.
    5. Electrical current limit set point and set point source.
    6. Entering and leaving evaporator water temperatures.
    7. Entering and leaving condenser water temperatures.
    8. Saturated evaporator and condenser refrigerant temperatures.
    9. Evaporator and condenser refrigerant pressure.
    10. Oil tank temperature.
    11. Oil tank pressure.
    12. Oil pump discharge pressure.
    13. Differential oil pressure.
    14. Compressor motor current per phase.
    15. Compressor motor percent RLA.
    16. Compressor motor voltage per phase.
    17. kW energy consumption and power factor.
    18. Compressor motor winding temperatures per phase.
    19. Purge operating mode.
    20. Purge operating status.
    21. Time until next purge run.
    22. Daily pumpout - 24 hours.
    23. Average daily pumpout - 7 Days.
    24. Purge refrigerant compressor suction temp.
    25. Purge liquid temp (chiller condenser saturated refrigerant temperature).
    26. Daily pumpout limit/alarm.
L. The chiller control panel shall provide password protection of all setpoints.
M. The controller shall have the ability to display all primary sub-system operational parameters on dedicated trending graphs. The operator must be able to create up to 6 additional custom trend graphs, choosing up to 10 unique parameters for each graph to trend log data parameters simultaneously over an adjustable period and frequency polling.
N. The chiller control panel shall provide individual relay outputs to start/stop the evaporator and condenser water pumps. The condenser water pump relay output can be used to enable the cooling tower temperature controls.
O. The chiller control panel shall provide leaving chilled water temperature reset based upon return water temperature.

P. The chiller control panel shall be capable of displaying system data in I-P or SI units.
Q. Safeties - the chiller control panel shall provide the following safeties:
    1. Low chilled water temperature.
    2. Low evaporator refrigerant temperature or pressure.
    3. High condenser refrigerant pressure.
    4. Evaporator and condenser water flow status.
    5. Low oil pressure.
    6. Low oil temperature.
    7. High oil temperature.
    8. High motor winding temperatures.
    9. High motor current.
    10. Starter/VFD function faults.
    11. Sensor faults.
    12. Unit controls operation.
    13. The chiller control panel or starter shall incorporate advanced motor protection to safeguard the motor throughout the starting and running cycles from the adverse effects of:
        a. Current phase loss.
        b. Current phase unbalance.
        c. Current phase reversal.
        d. Under/Over voltage.
        e. Motor current overload.
        f. Distribution fault protection with auto restart consisting of three-phase current sensing devices that monitor the status of the current.
        g. Starter contactor fault protection.
        h. Starter transition failure.
R. The chiller control panel shall provide evaporator freeze protection and low limit control to avoid low evaporator refrigerant temperature trip-outs during critical periods of chiller operation. Whenever this control is in effect, the controller shall indicate that the chiller is in adaptive mode. If the condition exists for more than 30 seconds, a limit warning alarm relay shall energize.
S. The chiller control panel shall be capable of providing short cycling protection.
T. The chilled water controller of each chiller shall include variable water-flow capability to allow the chiller to respond quickly to accelerating or decelerating water, and have the following features:
    1. The variable water-flow compensation capability shall allow control of the leaving chilled water temperature to within +/- 1.0°F (0.6°C) at a water flow rate change of 10% per minute and will stay online at a water flow rate change of 30% per minute.
U. The chiller, upon power loss restoration, must be able to start the compressor within 65 seconds. The chiller time to fully load up to 80% shall be no longer than 5 minutes. The manufacturer shall supply documentation to support their ability to do this.
    1. If the documentation is not adequate, the manufacturer must demonstrate this in the factory on an AHRI certified loop.
    2. See Section 2.13 for more information on restart demonstration.
V. The chiller control panel shall provide hardwire connections for the following binary and analog signals:
    1. Compressor Running.
    2. Detection by the panel of a fault requiring manual reset.
    3. Chiller operation at maximum capacity.
    4. Chiller operation in condenser limit mode and thereby requesting condenser water temperature relief.
W. The chiller control panel shall provide an analog 2 - 10VDC or 4 - 20mA output signal that shall indicate the Compressor Motor Percent RLA.
X. The chiller should have a condenser pressure output signal of 0 - 10VDC or 4 - 20mA that may be used for head pressure control if required.

Y. The chiller control panel shall allow for an analog input for a chilled water setpoint and an electrical current limit set point. These setpoints can be in the form of 4-20 mA or 2-10 Vdc signals from a remote source (i.e., generic building automation system).
Z. The chiller controller must be able to communicate directly to a building automation system using BACnet protocol (MSTP-RS 485).
AA. The unit mounted chiller controller must be able to communicate directly to a building automation system using a BACnet IP (Ethernet) link.
BB. Chiller Restart from Power Failure
1. The manufacture shall demonstrate the chillers capability to restart after a power loss and load up to 80% and 100% load respectively. The demonstration shall include the following sequence of events:
a. Begin the demonstration with the chiller running at design load.
b. Disengage power to the chiller for a period of 20 seconds.
c. Reapply power to the chiller and initiate the timer (note the time required for the compressor to start).
d. Next, note the time to establish 80% of the chiller load. (80% Load = 80% of Design Evaporator Delta T at Design Flow)
e. Next, note the time to establish 100% of the chiller load. (100% Load = 100% of Design Evaporator Delta T at Design Flow)
2. The chiller's compressor must restart within 65 seconds, reach 80% load within 240 seconds.
3. If the chiller manufacturer is not able to demonstrate stable chiller operation under rapid restart conditions in their facility, the contractor shall coordinate with a qualified and AHRI certified third party testing company to have the demonstrations completed per the specification.
4. If the chiller is unable to perform per the specification, the manufacturer must modify the unit and retest at their own expense until the testing requirements have been achieved. If the testing requirements cannot be met after modification, the owner can choose to reject the chiller at no cost to the owner.

2.9 STARTERS

A. FREQUENCY DRIVES AND STARTERS

1. The centrifugal water chiller shall be furnished with a liquid cooled variable frequency drive (VFD) as shown on the drawings. The VFD shall be factory mounted on the chiller and shipped completely factory assembled, wired, and tested.
2. The VFD will be specifically designed to interface with the centrifugal water chiller controls and allow for the operating ranges and specific characteristics of the chiller. The VFD control logic shall optimize chiller efficiency by coordinating compressor motor speed and compressor inlet guide vane position to maintain the chilled water setpoint while avoiding surge. If a surge is detected, VFD surge avoidance logic will make adjustments to move away from and avoid surge at similar conditions in the future.
3. The VFD efficiency shall be 97% or better at full speed and full load. Fundamental displacement power factor shall be a minimum of 0.96 at all loads.
4. The VFD shall be solid-state, microprocessor-based pulse-width modulated (PWM) design. The VFD shall be voltage and current regulated. Output power devices shall be IGBT transistors.
5. Power semi-conductor and capacitor cooling shall be from a liquid cooled heatsink.
6. The centrifugal water chiller shall be furnished with a refrigerant cooled variable frequency drive (VFD) to minimize maintenance and maximize cooling efficiency. If a water-cooling design is used, especially an open loop condenser water design, a cleanable shell and tube heat exchanger must be supplied. Plate and frame heat exchangers are not allowed. The VFD shall be factory mounted on the chiller and shipped completely factory assembled, wired, and tested.

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7. The VFDs shall each be furnished in a NEMA 1 metal enclosure having as a minimum a short circuit current rating (SCCR) of 65,000 amps per UL 508. It will include three phase input lugs plus a grounding lug for electrical connections, output motor connection via factory installed bus bars and all components properly segregated and completely enclosed in a single metal enclosure.
    a. Enclosure shall include a padlockable, door-mounted circuit breaker with shunt trip and AIC rating of 65,000 amps.
    b. The entire chiller package shall be UL/CUL listed.
8. The VFD shall be tested to ANSI/UL Standard 508 and shall be listed by a Nationally Recognized Testing Laboratory (NRTL) as designated by OSHA.
9. The VFD design shall include a standard integrated active rectification control system to limit total demand distortion (TDD) in current at the VFD to less than or equal to 5% as measured at the VFD input, in compliance to recommendations stated in IEEE 519-1992.
    a. If optional active or passive filters are used to meet the less than or equal to 5% TDD, then the losses associated with the filter shall be included in the chiller performance on the selection (adjust penalties accordingly).
    b. If a remote mounted filter is used to meet the less than or equal to 5% TDD, then the losses associated with the filter shall be included in the chiller performance on the selection (adjust penalties accordingly). Additionally, the remote filter must be brought in and tested along with the chiller for all applicable tests.
    c. If a remote mounted filter is used and is required to be tested, the contractor is responsible for all associated installation costs of the remote filter for testing.
10. Input shall be nominal 480V, 3-hase, 60Hz AC power, +/- 10% of nominal voltage.
11. Motor frequency range 38-60 hertz.
12. The VFD shall include the following features:
    a. All control circuit voltages are physically and electrically isolated from power circuit voltage.
    b. 150% instantaneous torque available for improved surge control.
    c. Soft start, adjustable linear acceleration, coast-to-stop.
    d. Insensitivity to incoming power phase sequence.
    e. Adjustable current limiting and UL approved electronic motor overload protection.
    f. Output line-to-line short circuit protection.
    g. Line-to-ground short circuit protection.
    h. Protection from phase loss at VFD input.
    i. Protection from phase reversal/imbalance.
    j. Protection from over/under-voltage.
    k. Protection from over-temperature.
13. The following VFD status indicators shall be available to facilitate startup and maintenance:
    a. Input line voltage.
    b. Output/load amps.
    c. Fault.
    d. Output speed in hertz and rpm.
    e. Input line kW.
    f. Average current in percent RLA.
    g. Load power factor.
    h. VFD transistor temperature.
14. Service Conditions – at full output power:
    a. No external venting or heat exchangers shall be required.
    b. Operating ambient temperature of 32-deg F – 104-deg F (0-deg C – 40-deg C).
    c. Room ambient up to 95% relative humidity.

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d. Elevation up to 3300 feet (1000 meters). For every 300 feet (90 meters) above 3300 feet, the rated output current shall be decreased by 1%.

2.10 TESTING

A. GENERAL

1. The chiller shall be factory performance tested with the proposed refrigerant under full-load conditions in an AHRI certified test facility. The manufacturer shall supply a certified test report to confirm performance as specified. Proper AHRI certification documents for the manufacturer's test loop shall be made available for inspection upon request.
2. The factory test instrumentation shall be per AHRI Standard 550/590, and the calibration of all instrumentation shall be traceable to the National Institute of Standards and Technology (NIST, formerly NBS).
3. The performance test shall be run with clean tubes in accordance with AHRI 550/590 to include the following:
   a. A downward temperature adjustment per AHRI 550/590 shall be made to the design leaving evaporator water temperature to adjust from the design fouling to the clean tube condition.
   b. An upward temperature adjustment per AHRI 550/590 shall be made to the design entering condenser water temperature to adjust from the design fouling to the clean tube condition.
   c. There shall be no exceptions to conducting the performance test with clean tubes and with temperature adjustments in (1) and (2). The manufacturer shall clean tubes, if necessary, prior to test to obtain a test fouling factor of .0000 $h \cdot ft^2 \cdot °F/Btu$.
4. The chiller performance test shall be run with the motor installed.

B. VERIFICATION TEST OF CHILLER FULL LOAD CAPACITY AND EFFICIENCY AT STANDARD AHRI TOLERANCE

1. The chiller shall be non-witness tested in the manufacturer's factory on an AHRI certified test loop. The chiller must be tested with AHRI tolerances. The AHRI tolerances are described in the latest version of AHRI Standard 550/590. The performance test points shall be as follows:
2. A certified test report of all data shall be submitted to the Contracting Officer prior to completion of the project. The factory certified test report shall be signed by an officer of the manufacturer's company.
3. The equipment will be accepted if the test is conducted in conformance with AHRI Standard 550/590 procedures and the proposed tolerances are met.
4. The manufacturer must test the chiller capacity and kW/ton efficiency at full load design conditions.
5. If the equipment fails to perform within proposed tolerances, the manufacturer will be allowed to make necessary revisions to their equipment and retest as required, at their own expense.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Provide for connection to electrical service. Include for connection of oil pump if required.
C. Provide for connection of electrical wiring between starter and chiller control panel, oil pump, and purge unit.
D. Furnish and install necessary auxiliary water piping for oil cooling units if required.
E. Arrange piping for easy dismantling to permit tube cleaning.
F. Provide piping from chiller relief device to outdoors. Size as recommended by manufacturer.

G. Chiller vibration isolation and the base type (i.e., floor pad) will be in accordance with ASHRAE Handbook, 1995, HVAC Applications, Chapter 43 Table 42.

3.2 MANUFACTURER'S FIELD SERVICES

A. All Startup, maintenance and monitoring functions shall be performed by a manufacturer's commercial agent to confirm, (in writing), that equipment has been correctly installed and passes specification checklist prior to equipment becoming operational and covered under OEM warranty.

B. Applied chiller manufacturers shall maintain service capabilities no more than 35 miles from the job site.

C. The manufacturer shall furnish complete submittal wiring diagrams of the chiller(s) starter(s) and associated components like cooling towers, pumps, interlocks, etc. as applicable for field maintenance and service.

END OF SECTION

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SECTION 23 70 00 - AIR HANDLING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The other Contract Documents complement the requirements of this Section. The General Requirements apply to the work of this section.

1.2 SCOPE

A. Provide material, equipment, labor, and supervision necessary to install modularly constructed central station indoor and rooftop mounted outdoor air handling units.

1.3 STANDARDS

A. Units shall have certified ratings complying with ARI Standard 430, and be UL listed.

B. Units shall meet the design intent of ASHRAE Standard 62.

C. Coils shall have certified ratings in accordance with ARI Standard 410.

1.4 QUALIFICATIONS

A. Units shall be of the modular component type with self-supporting frames equal to:

1. Tranel (Basis of Design)
2. Engineer-Approved Equal

1.5 SUBMITTALS

A. Submittal data shall consist of drawings showing unit dimensions, construction materials, fan performance curves, coil performance (capacity), damper leakage rates, horsepower, electrical characteristics, and installation instructions.

B. Manufacturers shall furnish for approval for each fan, certified sound power ratings with an octave band analysis and also the volume-pressure-horsepower characteristic curves from shut-off to free delivery.

C. Submit data on coils to include capacities, air and water flow rates, pressure and temperature drops, materials of construction and physical dimensions.

D. Where units other than that used as the basis of design are submitted, provide equipment room layout drawings at the time of ahu submittal to demonstrate coordination with the available space. Alternate equipment will not be reviewed without the layout drawings.

PART 2 - PRODUCTS

2.1 GENERAL

A. Units shall be factory built modular components and assembled with arrangements as indicated.

B. Units shall have capacities, arrangements, ratings and performance as scheduled.

C. Unit modular components shall be catalogued products of the air handling unit manufacturer. Components which are not manufactured specifically by the air handling unit manufacturer (including face and bypass sections, filter sections) are not acceptable. Motors, drives, and dampers shall be factory mounted within modular components.

2.2 CASINGS

A. All casings including fan, coil, filter, and access sections (both outside and return air) shall be constructed of internally insulated double-wall sandwich construction with solid inner wall of the best quality galvanized steel reinforced for maximum rigidity with steel angle framework as required. Each unit shall consist of a fan section, coil section with drain pan and a filter section, and other sections as detailed on the drawings.

1. Insulation shall be of the foam type with a minimum ‘R’ value of 12.5 ft^2 hour F/BTU

B. Belt guards shall totally enclose all moving parts.

C. The casing shall be designed for 1.5 times the design pressure equal to the negative of the maximum static pressure differential between the highest peak on the selected fan characteristic curve and ambient pressure or 8 inches, whichever is less, with panel deflection of 0.005 percent of span. The casing shall be furnished with lifting lugs or other attachments to facilitate handling. Exterior wall panels shall be a minimum of 18-gauge galvanized steel with a 20-gauge solid galvanized steel, internal liner.

D. Casing shall have removable panels to provide access to internal components. Coils shall be removable without disassembly of unit. Double wall access doors shall be provided in the filter and fan sections of sufficient size to allow access to and cleaning of all interior components.

E. All unit access doors including fan, coil, access and filter sections shall be double wall, fully gasketed with heavy duty steel hinges with fixed pins with a minimum of two heavy duty cam-lock type handles.

F. Drain pan shall be double wall stainless steel construction and provided under the complete fan and coil section for horizontal units and under the complete coil section for vertical units and other sections where water may collect. Drain pans shall be positively sloped in two directions to the drain connection. Drain pans shall be insulated with 1" insulation between the two pans.

2.3 FANS

A. All fans and shafts shall be manufactured by the unit manufacturer. Fan wheels shall be constructed of galvanized steel, double width, double inlet, centrifugal type. Fan type shall be of the type scheduled. Plug fans shall be single width/single inlet.

B. Internal bearings shall be provided with extended grease lines to unit exterior.

C. Fan housings shall be die-formed with streamlined inlets and side sheets. Bearings shall be grease lubricated ball bearings selected for an L-50 rating life of not less than 200,000 hours.

D. Fans shall be statically and dynamically balanced and factory run tested, in the unit. Fan performance shall be tested in accordance with ARI Standard 430-89 or AMCA 210 as appropriate. Excessive vibration shall be factory eliminated prior to shipment.

E. Fan shafts shall be solid and shall be designed such that they shall not exceed 75 percent of their first critical speed. Fan wheels shall be keyed to fan shafts.

F. Fan sections shall include an access door in the drive side of the fan.

2.4 COILS

A. Return Air Coils

1. Coils shall be furnished for cooling and heating media as scheduled. Coils shall be fully contained within the unit casing. Scheduled coil face velocities shall not be exceeded, and the manufacturer shall certify that no moisture carryover will occur. Performance shall be certified in accordance with ARI 410.
2. Coils shall be aluminum plate fin copper tube type. Fins shall have drawn, belled, collars bonded to the tubes by means of mechanical expansion of the tubes. Coil casings shall be stainless steel.
3. Coil capacity and performance characteristics shall be listed in schedule.

B. Outside Air Coils

1. Coils shall be furnished for cooling and heating media as scheduled. Coils shall be fully contained within the unit casing. Scheduled coil face velocities shall not be exceeded, and the manufacturer shall certify that no moisture carryover will occur. Performance shall be certified in accordance with ARI 410.
2. Coils shall be aluminum plate fin copper tube type. Fins shall have drawn, belled, collars bonded to the tubes by means of mechanical expansion of the tubes. Coil casings shall be stainless steel.

3. Coil capacity and performance characteristics shall be listed in schedule.
4. Coils shall be coated with factory anti-corrosion coating on the coil.

2.5 MOTORS AND DRIVES

A. Motors shall be NEMA Standard, TEFC, premium energy efficient E+3, 1.15 service factor, normal torque, 40-degrees C rise of the horsepower rating and electrical characteristics as scheduled on drawings.

B. Drives shall be rated at 1.5 service factor of the motor horsepower rating. Drives shall be adjustable speed drives for adjustment within plus or minus 10 percent of specified RPM.

C. Motor shall be mounted on an adjustable mount, suitable for adjusting belt tension and drive alignment.

D. Furnish and install motor access doors to allow for maintenance and motor replacement.

E. Provide galvanized steel belt guard.

F. A drive replacement (belts and sheaves) shall be included in the base contract price.

2.6 INSULATION

A. Shall be provided between dual wall casings as specified under Paragraph 2.2.

2.7 FILTERS

A. Provide filter section, suitable for use with 4-inch-deep filters, with access door suitable for side loading. Filter section shall be of the configuration indicated on the drawings and be of the medium capacity angle type unless otherwise noted or indicated.

B. Filter section shall be coordinated with the commercially available filter sizes. Where filter filler panels are required, they shall be constructed of heavy gauge galvanized steel and be sized to seal properly between the adjacent filter and unit frame/access door. Provide gasketing to prevent filter bypass.

C. Filters shall be removable without the use of hand tools or special equipment.

D. Four inch thick filters shall be MERV-13.

E. Provide factory gauges for pressure differential of filters.

2.8 ISOLATORS

A. Internal isolation with a minimum of 2-inch deflection shall be provided for the fan and drive sections. Provide a neoprene pad between casing and housekeeping pad for indoor units.

PART 3 - EXECUTION

3.1 INSTALLATION

A. For indoor units, lay out exact location and furnish to General Contractor a dimensional drawing showing base sizes and locations. Coordinate pad height as required to provide the required condensate trap depth. Do not use shipping lugs to achieve necessary height unless approved by the Engineer.

B. Install units and make refrigerant piping and duct connections.

C. Extend condensate drain line from drain pan, through a trap, to the nearest floor/roof drain and elbow into drain. Contractor shall provide sufficient height between drain pan and condensate drain trap to allow drainage against negative fan pressure.

D. Install fire resistant flexible connectors in ducts at connections to units. Flexible connectors shall be in accordance with NFPA 90A.

E. Do not operate units for any purpose until ductwork is clean, filters are in place, bearings lubricated, and the fan has been test run under observation.

F. Release vibration isolation restraining bolts.

END OF SECTION

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SECTION 23 73 00 - PACKAGED AIR HANDLING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

B. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Packaged Air Handling Units.

1.3 QUALITY ASSURANCE

A. All electrical components shall be listed and labeled by U.L., ETL or a Nationally Recognized Testing Laboratory (NRTL), listed and labeled.

B. Unit performance shall be certified in accordance with ARI Standard 430 for central station air handling units.

C. Coil performance shall be certified in accordance with ARI Standard 410.

D. All components in the conditioned air stream shall conform to the NFPA 90A Flame/Smoke/Fire Contribution Rating of 25/50/0.

E. All electrical devices shall conform to NEMA standards.

F. All wiring shall conform to the NEC.

G. When connected to a 277/480 VAC system, the heating coil shall be listed and labeled at 277 VAC or 480 VACS for single phase or three phase units respectively, regardless of the voltage scheduled on the drawings.

H. Direct expansion coils shall be designed and tested in accordance with ANSI/ASHRAE Standard 15 Safety Code for Mechanical Refrigeration.

I. After installation the manufacturer's representative of all equipment provided in this section shall certify in writing to the Owner's Representative that the equipment has been assembled and installed within the guidelines of the manufacturer's written installation instructions and that its performance meets or exceeds the operating characteristics, specified and/or scheduled.

J. In accepting this Contract, the air handling unit manufacturer shall guarantee their units to give capacities not less than the capacities specified with the conditions as specified, without the unit sweating in an unconditioned mechanical room, (it is understood that minor misting of the unit surface may occur at unit seams where thermal breaks do not exist. The manufacturer guarantees that they will take whatever steps are necessary to meet the guarantee, at no additional cost to the Owner, regardless of the extent of the revisions required. A Corporate Officer of the manufacturer shall certify the guarantee and the submittal data.

K. The work shall include a one-year warranty from final completion. This warranty shall be by the Contractor to the Owner for any defective workmanship or material which has been furnished at no cost to the Owner for a period of one year from the date of final completion of System. Extended warranty shall be provided for systems installed during earlier phases of construction through to final completion of the final phase. Explain the provisions of warranty to the Owner at the "Demonstration of Completed System" meeting to be scheduled with the Owner upon project completion.

L. Starting of Mechanical Systems:

1. Provide material and labor to perform start-up of each respective item of equipment and system prior to beginning of test, adjust and balance procedures.
2. Provide labor to assist the Owner's Representative in acceptance review.

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3. Provide point by point system check-out. Submit results in tabulated form by system. Include this data as part of Operation and Maintenance Manuals.
4. Provide information and assistance and cooperate with test, adjust and balance services.
5. Comply strictly with manufacturer's recommended procedures in starting up mechanical systems.
6. Provide such periodic continuing adjustment services as necessary to ensure proper functioning of mechanical systems until acceptance and up to 1 full year after date of Owner acceptance.

1.4 SUBMITTALS

A. Submit in accordance with Division 1 requirements.

B. No equipment shall be fabricated or delivered until the receipt of approved shop drawings from the Owner or Owner’s approved representative.

C. AHU manufacturer shall provide the following information with each shop drawing/product data submission:

1. Dimensioned arrangement drawings for each AHU including a plan and elevation view of the assembled unit with overall dimensions, lift points, unit shipping split locations and dimensions, installation and operating weights, and installation, operation, and service clearances.
2. All electrical, piping, and ductwork requirements, including sizes, connection locations, and connection method recommendations.
3. Each component of the unit shall be identified, and mechanical specifications shall be provided for unit and accessories describing construction, components, and options.
4. All performance data, including capacities and airside and waterside pressure drops, for components.
5. Fan curves shall be provided for fans with the design operating points indicated and at 15% greater RPM along the system curve with fan efficiency and horsepower clearly indicated. Data shall be corrected to actual operating conditions, temperatures, and altitudes.
6. Submit computer coil selection clearly indicating system design conditions, as well as coil hand connections, electric heating coil data, where applicable.
7. A filter schedule must be provided for each air handling unit supplied by the air handling unit manufacturer. Schedule shall detail unit tag, unit size, corresponding filter section location within the AHU, filter arrangement (e.g., angled/flat), filter depth, filter type (e.g., pleated media), MERV rating, and filter quantity and size.
8. A schedule detailing necessary trap height shall be provided for each air handling unit. Schedule shall detail unit tag, unit size, appropriate trap schematic with recommended trap dimensions, and unit supplied base rail height. Contractor shall be responsible for additional trap height required for trapping and insulation beyond the unit supplied base rail height by adequate housekeeping pad.
9. A coil valve coordination schedule shall be provided for each air handling unit supplied by the air handling unit manufacturer. Schedule shall detail unit tag, coil type and corresponding section location within the AHU, valve style (e.g., global, ball), valve type (e.g., electronic 2-way/3-way), valve position (e.g., normally open/closed), size, flow coefficient (CV), and close-off pressure.
10. An electrical MCA – MOP schedule shall be provided for each electrical circuit to which field-power must be supplied. Schedule to detail unit tag, circuit description, voltage/phase/hertz, Minimum Circuit Ampacity (MCA), and calculated Maximum Overcurrent Protection (MOP).

11. Sound data shall be provided using ARI 260 test methods. Unit discharge, inlet, and radiated sound power levels in dB shall be provided for 63, 125, 250, 500, 1000, 2000, 4000, and 8000 Hz.

D. The AHU manufacturer shall list any exceptions to the specification.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Packaged Air Handling Units:

1. Valent
2. Trane
3. Engineer-approved Equal

2.2 FABRICATION

A. Packaged Air Handling Units:

1. General:
   a. Sizes, types, and performance as indicated on unit schedule.
   b. Each unit complete with factory furnished components as shown on the plans. Each air handler unit shall be completely factory assembled, or partially assembled, tested, and shipped in one piece or in sections for field assembly depending on size. All casings and access doors shall be of double wall construction. All components shall be assembled on a base rail or mounting legs of sufficient height to provide proper condensate drain trapping, provided with the unit, complete with lifting lugs to accept cable in chain hooks.
   c. All units shall have decals and tags to indicate caution areas and to aid unit service. Nameplates shall be fixed to the unit.
2. Cabinet, Casing and Frame:
   a. Full height, hinged access doors with stainless steel hinge and lever latching mechanism shall provide access to each cabinet section from both sides. Access doors shall provide gasketing for a positive seal. Doors shall open outward for negative pressure and inward for positive pressure applications or have a double latching mechanism for safety.
   b. Unit shall be insulated with U.L. listed minimum 2 inch thick waterproof foam insulation. Insulation to have a minimum thermal resistance or “R-Value” of 13.
   c. Unit casing (wall/floor/roof panels and doors) shall be able to withstand up to 1.5 times design static pressure, or 8 inch w.g., whichever is less, and shall not exceed 0.0042 inch per inch of panel span (L/240).
   d. Casing air leakage shall not exceed 1% of design airflow at the specified casing pressure.
   e. Exterior panels of all sections shall be constructed of 18 gauge or heavier galvanized steel. All sections shall include galvanized steel internal liners. Wall thickness shall be 2 inches.
   f. Casing panel inner liners must not extend to the exterior of the unit or contact the exterior frame. A mid-span, no-through-metal, internal thermal break shall be provided for all unit casing panels.
3. Access Doors:
   a. Access doors shall be 2 inch double-wall construction. Interior and exterior shall be of the same construction as the interior and exterior wall panels.

b. All doors downstream of cooling coils shall be provided with a thermal break construction of door panel and door frame.

c. Gasketing shall be provided around the full perimeter of the doors to prevent air leakage.

d. Door hardware shall be surface-mounted to prevent through-cabinet penetrations that could likely weaken the casing leakage and thermal performance.

e. Handle hardware shall be designed to prevent unintended closure.

f. Access doors shall be hinged and removable without the use of specialized tools to allow.

g. Hinges shall be interchangeable with the door handle hardware to allow for alternating door swing in the field to minimize access interference due to unforeseen job site obstructions.

h. Door handle hardware shall be adjustable and visually indicate locking position of door latch external to the section.

i. All doors shall be a minimum 60 inches high when sufficient height is available, or the maximum height allowed by the unit height.

j. A single door handle shall be provided for each door linking multiple latching points necessary to maintain the specified air leakage integrity of the unit.

k. A shatterproof window shall be provided in fan access doors.

4. Coil Sections:

a. Coil sections shall be blow thru or draw thru as scheduled or detailed on drawings and incorporate single or multiple coils. Coils shall be guaranteed to have no moisture carry-over.

b. Coil row depth shall match that shown on the air handling unit schedule, except that the minimum row depth shall be that listed, or 8 rows, whichever is less. Maximum fin density shall be 130 fins per foot, regardless of the value scheduled.

c. Water coils shall be of the cartridge type and have threaded connections (direct expansion coil shall have sweat-type connections) located on the same end. Coil headers, distributors and connections shall be completely enclosed in the unit casing. Vent and drain connections shall be provided on all water cooling coils. Coil supports shall be Type 304 stainless steel.

d. Coils shall have non-ferrous headers and copper tubes, mechanically bonded to ripple-corrugated aluminum fins. Coils shall have a staggered tube type design. Coils shall have Type 304 stainless steel casing. Coils shall be certified in accordance with Air Conditioning and Refrigeration Institute (ARI) Standard 410-72. Coil performance shall be substantiated by computer generated output data. Coils shall be suitable for glycol solutions.

e. Chilled water coils shall have 1/2 inch or 5/8 inch O.D. copper tubes. Coils shall be circuited for minimum pressure drop. Coils shall be tested at 315 pounds air pressure under warm water and be guaranteed for 150 psig working pressures. Coils shall be guaranteed to produce no carryover.

5. Electric Heating Coil Section:

a. Electric heating coils shall be of the slip-in or flange type, using wire construction of 80% nickel and 20% chromium supported in ceramic bushings. The heating wire for each step shall be strung along the entire coil face to prevent stratification when operating at less than full capacity.

b. Terminals and nuts shall be constructed of stainless steel and terminal insulators and bracket bushings shall be constructed of ceramic securely stacked in position. Coil terminals shall be machine crimped to coil wires.

c. Casings shall be constructed of not lighter than 22-gauge galvanized steel with galvanized steel supports on 4 inch centers, gusseted and spot welded. A solid cover shall be provided on the terminal box conforming to Paragraph 5.6 of U.L Standard 1096. Three-eighths inch thick rigid fiberglass without metal-to-metal contact shall be installed between the coil and terminal box.

d. Coils shall be tested at twice the rated voltage plus 1,000 volts or at 2,000 volts, whichever is greater. The coils shall be tested and certified for the following: ohm readings to verify capacity, voltage, phase, and control voltage.

e. Safety features shall include an automatic rest thermal cutout wired in series with the control and the heat limiters wired in series with the power legs. All safety devices shall be serviceable through the terminal box without removal of the heater from the duct.

f. Built-in components shall include an interlocking disconnect switch, contactors, primary fused transformer, single terminal block, pressure type airflow switch and branch circuit fuses per NEC. All components shall be factory wired and mounted either on the heating coil or in a remote cabinet when shown on the drawings. When the interlocking disconnect switch is built in or externally powered, control circuits are indicated, door interlock micro switches shall be installed at the factory. The frame of the heater shall be provided with a ground stud wired to the terminal block for connection to an external grounding conductor.

g. Solid State Control Relay (SCR) to be provided for infinitely variable power output from 0 to 100% in direct proportion to temperature requirements. Heaters in excess of 20 KW shall have a "vernier" control with an SCR relay and electronic step controller with a minimum of three steps of control. The SCR circuit shall have a KW rating larger than each of the other circuits. The SCR circuit shall be arranged to be first on and last off. When the temperature sensor calls for heat, the SCR circuit will begin to modulate from 0 to 100% capacity. When it reaches 100%, it will stay for one to two minutes. A signal is then sent to the electric step controller to bring in a fixed KW step. The SCR shall then fine tune the KW output. The reverse action shall take place on a fall in temperature. The SCR shall stay at zero output for one or two minutes and then a fixed step shall go off.

h. Contactors shall be of the mercury disconnecting type.

i. Recessed terminals shall be provided where heating coils are installed in internally lined factory fabricated air handling units. Watts density as measured in watts per square inch of wire surface shall not exceed 35 when installed in draw-through units and 25 when installed in blow-through or VAV units.

6. Condensate Pan:

a. A double wall condensate drain pan consisting of inner 18-gauge 304SS pan, an outer 18-gauge galvanized steel pan and minimum 5/8 inch thick rigid foam insulation between the two pans.

b. Pan shall be non-trapping design sloped to the drain connection and guaranteed not to have standing water after shut-down. It shall extend beyond the leaving airside of the cooling coil and extend underneath the coil connections.

c. The drain pan shall be thermally isolated from the unit casing. A threaded drain connection shall extend through the unit base.

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d. For stacked coils, an intermediate Type 304 stainless steel drain pan extending a minimum of 6 inch past shall be provided with drop tubes on each end, or a method to transfer condensate to the lower drain pan shall be provided.

7. Supply Air Fan Section (Refer to Drawing Schedule):
   a. Supply fans shall be double width, double inlet centrifugal type. All fans shall be statically and dynamically balanced for quiet operation. Forward curved fan wheel and housing shall be fabricated from painted cold rolled steel or continuous galvanized steel. Backward curved or Airfoil fan wheels shall be fabricated from aluminum, painted steel, or aluminum alloy with fan blades continuously welded to the back plate and end rim and shall operate in a continuous galvanized steel housing. Units shall have solid steel shafts mounted in heavy-duty 200,000 hour greaseable ball bearings. Lubrication lines for the fan bearings shall be extended to the drive side of the unit and shall be copper only. The entire fan assembly shall be completely isolated from the unit bulkhead with vibration absorbing fan discharge seal and mounted on 2 inch deflection spring isolators for all units above 3,000 CFM capacity. For units 3,000 CFM and less, 1 inch deflection internal or external spring isolators may be provided.
   b. Fans shall be forward curved, backward curved or Airfoil as scheduled.
   c. The units shall be rated for an RPM 15% greater than that required at the point of selection. If necessary, heavier class construction is to be provided.
   d. Fans for blow-thru applications shall incorporate a discharge diffuser.
   e. Fan motors shall be heavy duty, high efficiency, 1800 RPM, open drip-proof type with greaseable ball bearings as specified in Section 23 05 13. The motor shall be provided with have a fixed pitch drive rated to provide 1.4 service factory and be mounted on an adjustable base for proper alignment and belt tension adjustment. Variable volume control will be by adjustable frequency drive as specified in Section 23 05 17.
8. Direct Drive Plenum Fans (Refer to Drawing Schedule):
   a. Fan shall be direct driven, arrangement 4 plenum fan constructed per AMCA requirements for the duty specified. The fan or fans in total shall be selected to deliver the specified airflow quantity at the specified operating Total Static Pressure.
   b. Fan/motor assemblies will be internally isolated with spring isolators and flex collars.
   c. Fan motors shall be E+3, inverter ready pedestal mounted, ODP selected at the operating voltage and efficiency as specified or as scheduled elsewhere. Each fan motor shall be sized so the fan maximum brake horsepower does not exceed motor’s nominal nameplate rating.
   d. All motors shall include isolated bearings or shaft grounding option.
   e. Fans shall be positioned in the air tunnel cross section and with adequate spacing upstream and downstream for servicing and airflow.
   f. Fan downstream access door width shall be wide enough to permit the fan motor, fan wheel or fan motor/wheel removal.
   g. Fans shall be supplied with a Piezometer Flow measuring station consisting of multiple recessed measuring ports located at the narrowest throat on the inlet cone and a static reference port in the unit. Flow measuring station shall not obstruct the inlet of the fan and shall have no effect on fan performance (flow or static) or sound power levels. Piezometer Flow measurement system will be supplied and installed by the fan manufacturer.

h. Piezometer signal shall be converted thru an accurate pressure transducer into a 0–10-volt output control signal. Provide a fan calibration formula to convert the flow signal into the fan CFM.

i. Units will have an ETL or UL 1995 label.

9. Filter Section:

a. The filter section shall be capable of accepting 2 inch - 30% pre-filters. They shall be supplied complete with galvanized steel filter racks as an integral part of the unit.

b. Provide fixed filter block-offs as required to prevent air bypass around filters.

c. Filters shall be accessible from both sides of the unit or as shown on the documents.

d. The filter section shall be provided with filters and filter differential pressure gauge (refer to controls drawings) as specified in Section 23 41 00.

10. Return Air/Outdoor Air Mixing Section:

a. A return air plenum shall provide 100% return air capability. A duct collar shall accept return air ductwork return air connection as detailed on drawings.

b. If required: 0-100% economizer dampers shall allow for modulating 0-100% outdoor air intake. The 0 - 100% economizer dampers shall consist of outside air, return air and exhaust air dampers arranged to provide mixing of the airstreams. The outside and return air damper shall be sized to handle 100% of the supply air volume and be of a low leak design including gasketing and side seals on all blade edges. Blades shall be of a heavy-duty, airfoil design. Leakage shall not exceed 4 CFM/SF at 1 inch w.g.

11. Factory Plenum Section Casing: Reinforced mill galvanized or primed steel with baked finish, minimum 18 ga. panels, gasketed joints between panels, 1 inch thick, 3 lbs. density glass fiber insulation with vapor barrier, access doors with safety latch handles. Suitable for 6.0 inch w.g. positive or 4 inch w.g. negative static. Field Built Plenums are NOT acceptable.

12. Discharge Air Plenum: A discharge air plenum shall be provided for sound attenuation with outlet velocities as scheduled and will have 1 inch duct collar for a bottom or front supply air duct connection as detailed.

PART 3 - EXECUTION

3.1 GENERAL

A. Indoor floor mounted units shall be installed on minimum 4 inch concrete housekeeping pads.

B. Install 6 inch manufacturer base rail to allow for condensate trapping.

C. The Mechanical Contractor shall level all unit sections in accordance with the unit manufacturer’s instructions. The Mechanical Contractor shall provide and install all necessary permanent shim material to ensure individual sections and entire assembled units are level.

D. The Mechanical Contractor shall be responsible to coordinate ALL of his installation requirements with the Owner and the Owner’s selected Mechanical Contractor to ensure that a complete installation for each unit is being provided. Coordination efforts shall include such items as unloading and hoisting requirements, field wiring requirements, field piping requirements, field ductwork requirements, requirements for assembly of field-bolted or - welded joints, and all other installation and assembly requirements.

E. The AHU manufacturer shall provide all screws and gaskets for joining of sections in the field.

F. If equipment is to be stored for a period of time prior to installation, the Mechanical Contractor shall remove all stretch or shrink wrap from units upon receipt to prevent unit corrosion and shall either place the units in a controlled indoor environment or shall cover the units with canvas tarps and place them in a well-drained area. Covering units with plastic tarps shall not be acceptable.

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G. Assemble and install in accordance with manufacturers written installation instructions and details on drawings.

H. Coordinate duct, piping and electrical work so as to provide access to unit for maintenance, filter replacement, coil, fan shaft and motor removal with minimum disturbance of piping.

I. Mount units at proper elevation and arrange condensate trap for proper drainage at design pressure differential. Pipe condensate to nearest floor or roof drain.

J. Install air vents and drain valves to permit proper venting and drainage.

K. Prior to unit start-up all controls shall be installed and tested.

L. Prior to initial start-up and for system testing install air filters to protect the unit and ductwork from dirt and debris. After the system has been tested and prior to turning the system over to the Owner, replace the pre-filters with new, clean filters as specified.

M. All joints or assembled seams of the assembled unit shall be caulked or gasketed airtight up to 1.5 times design static pressure, or 8 inch w.g., whichever is less, and shall not exceed 0.0042 inch per inch of panel span (L/240).

N. Prior to turning the system over to the Owner, all damages incurred during shipping, storing, and installing shall be repaired. These repairs shall be sufficient to bring the equipment back to the quality standards equal to the original manufacturing standards. These repairs shall include but are not limited to repairing painted surfaces, dent removal, combing coil fins, repairing, or replacing wet, sagging or torn insulation, etc.

O. Electric Heating Coils:

1. Install heaters so that the access door can swing fully open, without restriction.
2. Provide uniform duct transition into and out of coil for uniform heating.
3. In cases where coil is inserted in internally lined duct, provide the necessary cold ends and flanges to prevent hot spots.
4. Install in proper direction of airflow to ensure that thermal cut-outs are downstream for proper over temperature protection.
5. Coordinate the control stages, etc. with the temperature control contractor.

END OF SECTION

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SECTION 23 81 26 - DUCTLESS DX SPLIT SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The other Contract Documents complement the requirements of this section. The General Requirements apply to the work of this section.

1.2 SCOPE

A. Provide material, equipment, labor, and supervision necessary to install ductless DX split systems.

B. Unit ratings, capacities, and characteristics shall be as scheduled on Drawings.

1.3 STANDARDS

A. Performance shall be in accordance with the applicable ARI 210/240 Standards. Unit shall be rated as a matched system.

B. Compressor motors, starters, wiring and control wiring shall all conform to NEMA, UL, NEC, and local utility requirements.

1.4 SECTION INCLUDES

A. Condensing unit package.

B. Air handling unit.

C. Charge of refrigerant and oil.

D. Controls and control connections.

E. Refrigerant piping connections.

F. Motor starters.

G. Electrical power connections.

1.5 SUBMITTALS

A. Submit shop drawings indicating components, assembly, dimensions, weights and loadings, required clearances, and location and size of field connections. Include schematic layouts showing condensing units, air handling units, cooling coils, refrigerant piping, and accessories required for complete system.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data.

B. Include start-up instructions, maintenance instructions, parts lists, controls, and accessories.

1.7 WARRANTY

A. Provide five-year extended compressor replacement warranty (parts only).

B. First Year Warranty: Include material coverage for refrigerant compressors, condenser coils, air handling unit, fans, controls electrical devices and related system components.

1.8 MANUFACTURERS

A. Provide products by one of the following:

1. Trane
2. Mitsubishi
3. Daikin.

PART 2 - PRODUCTS

2.1 CONDENSING UNITS

A. Type:

1. Units: Self-contained, packaged, factory assembled and pre-wired units suitable for outdoor use consisting of cabinet, compressors, condensing coil and fans, integral sub-cooling coil, controls, liquid receiver, and screens.
2. Construction and Ratings: In accordance with ARI 210/240. Testing shall be in accordance with ASHRAE 14.
3. Performance Ratings: Energy Efficiency Rating SEER not less than prescribed by ANSI/ASHRAE 90A, and the "Energy Efficiency Code for Building Construction", minimum of 13.0 SEER.
4. See Schedule on Drawings for unit capacities, electrical characteristics, and performance criteria.
5. Provide condensing unit with a holding charge of refrigerant and oil.
6. Inverter type unit see schedule.

B. Casing

1. House components in welded frame with steel panels with weather resistant, baked enamel finish.
2. Mount starters, disconnects, and controls in weatherproof panel provided with full opening access doors.
3. Provide removable access doors or panels with piano hinges and quick fasteners.

C. Condenser Coils

1. Coils: Aluminum fins mechanically bonded to seamless copper tubing. Provide sub-cooling circuits. Air test under water to 425 psig and dehydrate. Seal with holding charge of nitrogen or refrigerant.

D. FANS AND MOTORS

1. Vertical discharge direct driven propeller type condenser fans with fan guard on discharge. Equip with roller or ball bearings with grease fittings extended to outside of casing.
2. Weatherproof motors suitable for outdoor use, single phase permanent split capacitor or 3 phases, with permanent lubricated ball bearings and built-in thermal overload protection.
3. High efficiency motors as indicated.

E. Compressors

1. Construction: Hermetic, scroll or reciprocating type with heat treated forged steel or cast-iron shafts, aluminum alloy connecting rods, automotive type pistons, rings to prevent gas leakage, suction, and discharge valves, and sealing surface immersed in oil.
2. Mounting: Statically and dynamically balance rotating parts and mount on spring or rubber-in-shear vibration isolators. Internally isolate hermetic units on springs.
3. Lubrication System: Reversible, positive displacement oil pump with oil charging valve, oil level sight glass, oil filter, magnetic plug or strainer.
4. Motor: Constant speed suction gas cooled with electronic sensor and winding over temperature protection, designed for across-the-line starting. Furnish with starter.
5. Crankcase Heater: Evaporates refrigerant returning to crankcase during shut down. Energize heater continuously and when compressor is not operating.

2.2 AIR HANDLING UNIT

A. Type:

1. Ductless, wall mounted, direct expansion fan coil units.
2. Unit shall include evaporator coil, fan, fan motor, piping connections, drain pan, and integral controls.

3. Unit shall include necessary factory provided wall mounting hardware.

B. Cabinet:

1. Integral discharge grille and intake type, high-impact polystyrene.
2. Fully insulated for acoustic and thermal protection.

C. Fans:

1. Direct drive with motor driven vertical air sweep function.
2. Open drip-proof permanently lubricated ball bearing motor with inherent overload protection. Motors shall be 3-speed.

D. Coil:

1. Copper tube coil with aluminum fins and galvanized steel tube sheets.
2. Drain pan shall be non-corrosive and include an integral trap.

E. Filters:

1. Factory supplied and installed cleanable type.

2.3 CONTROLS

A. Controls shall consist of a microprocessor-based control system, which shall control space temperature, determine optimum fan speed, and run self-diagnostics. The temperature control range shall be from 64-degrees F to 84-degrees F. The unit shall have the following functions as a minimum:

1. An automatic restart after power failure at the same operating conditions as at failure.
2. A timer function to provide a minimum 24 hour timer cycle for system Auto/Start/Stop.
3. Temperature-sensing controls shall sense return air temperature. Indoor air high discharge temperature shutdown shall be provided.
4. Indoor coil freeze protection.
5. Wireless infrared remote control to enter set points and operating conditions.
6. Auto Stop features shall have integral setback control.
7. Automatic air sweep control to provide on or off activation of air sweep louvers.
8. Dehumidification mode shall provide room air circulation when no cooling is required.
9. Fan only operation shall provide room air circulation when no cooing is required.
10. Diagnostics shall provide continuous checks of unit operation and warn of possible malfunctions. Error messages shall be displayed at the unit and at the remote controller.
11. Fan speed control shall be user-selectable: high, medium, low, or microprocessor automatic operation during all operating modes.
12. A time delay shall prevent compressor restart in less than 3-minutes.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The Contractor shall install equipment in accordance with manufacturer's instructions.

B. Provide for connection to electrical service. Refer to Division 26.

C. Install units as indicated.

D. Provide connection to refrigeration piping system and evaporators. The Contractor shall provide and install the following for each refrigerant circuit:

1. Suction and liquid line filter dryer replaceable core type.
2. Liquid line sight glass and moisture indicator

3. Insulated suction line.
4. Suction and liquid line service valves and gage ports at condensing unit.
5. Charging valves.
6. Refrigerant and oil.
7. Comply with ANSI/ASHRAE 15.

3.2 CONTRACTOR'S FIELD SERVICES

A. Prepare and start systems.

B. Supply initial charge of refrigerant and oil for each refrigerant circuit. Replace losses of refrigerant and oil.

C. Inspect and test for refrigerant leaks quarterly during first year of operation. Repair all leaks and replace losses of refrigerant and oil to meet manufacturer's specifications.

END OF SECTION

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SECTION 23 82 19 - ELECTRIC RESISTANCE DUCT HEATERS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The other Contract Documents complement the requirements of this section.

B. The General Requirements apply to the work of this section.

1.2 SCOPE

A. Provide material, equipment, labor, and supervision necessary to electric resistance heaters in the duct system as required.

1.3 QUALIFICATIONS

A. Duct heating coils shall be Brasch, Indeeco, Markel or Warren.

1.4 SUBMITTALS

A. Submittal data shall consist of drawings showing coil dimensions, construction materials, watt density, ratings and performance including pressure drops on airside.

B. Wiring Diagrams: Furnish a separate, complete wiring diagram for each heater.

1. Diagram shall include recommended supply wire gauges per NEC, and fuse sizes.
2. Typical wiring diagrams are not acceptable.
3. Each heater shall be complete with clearly marked power and control terminals.

C. Verify control panel size, door swing and duct size with contractor supplied ductwork shop drawings prior to submittal and ordering heaters.

1. Verify electrical characteristics and control requirements prior to order.

PART 2 – PRODUCTS

2.1 EQUIPMENT

A. Duct heaters shall be open coil heaters.

1. Voltage, size, wattage, number of steps and control voltage shall be as scheduled on the drawings.
2. Furnish three-phase heaters with balanced three-phase steps.
3. Heaters shall be UL listed for zero clearance and meet all applicable requirements of the NEC.

B. Type: Heaters shall be of the slip-in type for duct mounting.

C. Elements shall be of 80% nickel and 20% chromium; steps arranged to prevent stratification when operating at less than full capacity.

1. The maximum watts per square inch of wire surface shall be up to 150 HW=50.

D. Coil terminals shall be of stainless steel, terminal insulators and bracket bushings shall be of ceramic and securely positioned.

1. Terminals shall be machine crimped to coil.

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E. Frame shall be of sufficiently heavy gauge galvanized steel to assure structural rigidity and have vertical galvanized steel supports with stiffening ribs and gussets spaced no more than 4” apart, spot welded to the casing.

F. Provide terminal box with solid hinged cover in order to minimize dust infiltration.

1. Heater terminal box must be totally enclosed and must be without perforated or expanded sheet metal covers and insulated.

G. Provide a recessed terminal box for coils installed in ducts with internal obstruction greater than 1" to assure that heating elements and safety controls are in the air stream.

H. Orientation: Heaters shall be interchangeable for mounting in a horizontal or vertical duct.

I. Safety Devices:

1. Furnish a disc type automatic reset thermal cutout for primary over temperature protection.

2. For secondary protection, a sufficient number of heat limiters in the power lines shall de-energize elements if the primary cutout fails.

3. All safety devices shall be serviceable through the terminal box without removing the heating coil from the duct.

J. Built-in components shall include disconnecting break magnetic contactors, transformer with primary fusing, pressure-type airflow switch set at .07" WC, all as required by UL, branch circuit fuses per NEC, interlocking disconnect switch and a single terminal block to accept the number, type and size of conductors as required.

1. Insulate the terminal box.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install systems as required and as recommended by the electric heater supplier.

B. Mount the electric heater in the duct in accordance with the requirements of SMACNA Ducted Electric Heat Guide.

C. The electric heater shall occupy entire cross-sectional area of duct.

END OF SECTION

SECTION 26 01 00 - OPERATION AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the sections included under Division 1, General Requirements, are included as a part of this section as though bound herein.

1.2 SUMMARY

A. O & M Manuals contain copies of all warranties, operation and maintenance instructions, and other pertinent information relative to the project that is used throughout the life of the facility. This section contains additional requirements for the preparation of Electrical and Systems Operation and Maintenance Manuals.

1.3 OPERATION AND MAINTENANCE MANUALS

A. General: Refer to Section 01 77 00 Closeout Procedures.

B. O & M Data:

1. Manufacturers' operation and maintenance data is required for all items as called for in the specifications. O & M Manuals shall include manufacturer's name, model number(s), characteristics, manufacturer's agent, service agent, supplier, where and/or what item(s) are used for and description (i.e., surge suppression - switchboard MDPA).
2. Include troubleshooting instructions, list of special tools required, theory of operation, manufacturer's care and cleaning, preventative maintenance instructions, wiring diagrams, and point-to-point schematics.

C. O & M Manuals to include, but are not limited to:

1. Completed forms and information contained in Division 1 General Requirements, Section 01 77 00, and this section of the specifications. Reinforced separation sheets tabbed with the appropriate specification reference number and typed index for each section in the Systems Schedule.
    a. Project Information Sheet (Exhibit A MCSD)
    b. O & M Cover Examples (Exhibits B/C MCSD)
    c. Spare Parts/Maintenance Stock Certification (Exhibit D MCSD)
    d. Check Out Memo
    e. Conductor Insulation Resistance Test Memo
    f. Ground Test Information
    g. Voltage and Amperage Readings (Tabulated Data)
    h. Progress and Record Drawing Certification
2. Shop Drawings: Shop drawings shall be a copy of the final and accepted shop drawing submitted in accordance with Division 1 requirements.
3. Product Data: Product data and/or catalog sheets shall be a copy of the final and accepted submittal in accordance with Division 1 requirements. These shall be inserted in binder in proper order.
4. Warranties/Guarantees: Provide copies of warranties/guarantees in respective location in O & M binder, (Power and Lighting) (Systems). Original warranties/guarantees are to be incorporated as noted in Division 1 General Requirements.
5. Copies of electrical panel schedules and electrical panel directories included with the corresponding specification section.
6. Wiring diagrams, schematics, etc. inserted in proper order, for:

a. Time clocks.
b. Photocells.
c. Control devices, motor controls.
d. UPS systems.
e. Transformers.
f. Panelboards.
g. Distribution panelboards.
h. Switchboards.
i. Each and every part of Divisions 27 and 28 sections of these Specifications

7. Division 26
   a. Section 26 05 19, “Building Wire and Cable”
      i. Product data and/or catalog sheets on all products applicable to this project.
   b. Section 26 05 26, “Grounding and Bonding”
      i. Product data and/or catalog sheets on all products applicable to this project.
      ii. Test results on each ground rod.
      iii. Ground Test Information Form
   c. Section 26 05 29, “Hangers and Supports”
      i. Product data and/or catalog sheets on all products applicable to this project.
   d. Section 26 05 33, “Conduit”
      i. Product data and/or catalog sheets on all products applicable to this project.
   e. Section 26 05 34, “Outlet Boxes”
      i. Product data and/or catalog sheets on all products applicable to this project.
   f. Section 26 05 35, “Pull and Junction Boxes”
      i. Product data and/or catalog sheets on all products applicable to this project.
   g. Section 26 05 37, “Surface Raceways”
      i. Product data and/or catalog sheets on all products applicable to this project.
   h. Section 26 05 38, “Floor Boxes”
      i. Product data and/or catalog sheets on all products applicable to this project.
      ii. Equipment supplier list for section's equipment.
      iii. Installation/removal instructions.
      iv. Parts list.
   i. Section 26 05 43, “Underground Ducts and Raceways for Electrical Systems”
      i. Product data and/or catalog sheets on all products applicable to this project.
   j. Section 26 05 53, “Identification for Electrical Systems”
      i. Product data and/or catalog sheets on all products applicable to this project.
      ii. Equipment supplier list for each section's equipment.
   k. Section 26 05 73, “Power System Study”
      i. Copy of complete Study.
   l. Section 26 09 23, “Occupancy Sensors”
      i. Product data and/or catalog sheets on all products applicable to this project.

ii. Equipment supplier list for section's equipment.
iii. Wiring diagrams.
iv. Parts list.
v. Operation and maintenance requirements.

m. Section 26 22 13, “Dry Type Transformers.”
i. Product data and/or catalog sheets on equipment applicable to this project.
ii. Equipment supplier list for section’s equipment.
iii. Recommended periodic testing procedures.
iv. Parts list.
v. Any special manufacturer suggested O & M information.
vi. Installation/removal instructions.
vii. Check-Out Memo Form.

n. Section 26 24 13, “Distribution Switchboards”
i. Product data and/or catalog sheets on equipment applicable to this project.
ii. Equipment supplier list for section’s equipment.
iii. Internal wiring diagrams.
iv. Bus diagrams.
v. Operation and maintenance requirements, instructions, and recommended testing.
vi. Parts list.
vii. Copy of directory.
viii. Voltage and Amperage Readings Tabulated Data Form
ix. Check-Out Memo Form
x. Overcurrent protective devices: in addition to above provide the following for large circuit breakers:
a) Parts list.
b) Operation and maintenance requirements.
c) Wiring diagrams.
d) Testing data.
e) Installation/removal instructions.
f) Check-Out Memo Form.

o. Section 26 24 16, “Panelboards”
i. Product data and/or catalog sheets on equipment applicable to this project.
ii. Equipment supplier list for section’s equipment.
iii. Internal wiring diagrams.
iv. Bus diagrams.
v. Operation and maintenance requirements, instructions, and recommended testing.
vi. Parts list.
vii. Copy of directory.
viii. Voltage and Amperage Readings Tabulated Data Form

ix. Check-Out Memo Form

p. Section 26 24 17, “Distribution Panelboards”
   i. Product data and/or catalog sheets on equipment applicable to this project.
   ii. Equipment supplier list for section’s equipment.
   iii. Internal wiring diagrams.
   iv. Bus diagrams.
   v. Operation and maintenance requirements, instructions, and recommended testing.
   vi. Parts list.
   vii. Copy of directory.
   viii. Voltage and Amperage Readings Tabulated Data Form
   ix. Check-Out Memo Form
   x. Overcurrent protective devices: in addition to above provide the following for large circuit breakers:
      a) Parts list.
      b) Operation and maintenance requirements.
      c) Wiring diagrams.
      d) Testing data.
      e) Installation/removal instructions.
      f) Check-Out Memo Form

q. Section 26 27 13, “Utility Service Entrance”
   i. Product data and/or catalog sheets on products applicable to this project.
   ii. Equipment supplier list for section’s equipment.
   iii. Utility Company prepared drawings.

r. Section 26 27 16, “Cabinets and Enclosures”
   i. Product data and/or catalog sheets on products applicable to this project.
   ii. Equipment supplier list for section’s equipment.

s. Section 26 27 26, “Wiring Devices”
   i. Product data and/or catalog sheets on all products applicable to this project.
   ii. Equipment supplier list for section's equipment.
   iii. Ground faulty wiring devices; in addition to above provide:
      a) Wiring diagram.

t. Section 26 28 19, “Enclosed Disconnect Switches.”
   i. Product data and/or catalog sheets on equipment applicable to this project.
   ii. Equipment supplier list for section’s equipment.

u. Section 26 29 13, “Motor Control”
   i. Product data and/or catalog sheets on equipment applicable to this project.
   ii. Equipment supplier list for section’s equipment.
   iii. Motor Control: in addition to above provide the following:
      a) Internal wiring diagrams.
      b) Wiring diagrams.

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c) Bus diagrams.
d) Operation and maintenance requirements, instructions, and recommended testing.
e) Parts list.
f) Copy of directory.
g) Check-Out Memo Form

v. Section 26 36 23, “Manual Transfer Switch.”
i. Internal wiring diagrams.
ii. Wiring diagrams.
iii. Bus diagrams.
iv. O and M maintenance requirements, instructions and recommended testing.
v. Parts list.
vi. Copy of directory.
vii. Testing data, motor test information sheets
viii. Check Out Memo Form
ix. Narrative of emergency system operation, control, etc.

w. Section 26 43 00, “Surge Protective Devices”
i. Product data and/or catalog sheets on all equipment applicable to this project.
ii. Equipment supplier list.
iii. Parts list.
iv. Recommended testing and replacement procedures.

x. Section 26 51 13, “Interior Lighting Fixtures, Lamps and Ballasts”
i. Product data and/or catalog sheets on all equipment applicable to this project.
ii. Equipment supplier list.
iii. Operation and maintenance requirements/instructions for special light fixtures (these fixtures to be determined by A/E) including:
a) installation/removal instructions
b) special re-lamping instructions.
iv. Parts list.

y. Section 26 52 13, “Emergency Lighting Equipment”
i. Product data and/or catalog sheets on all equipment applicable to this project.
ii. Equipment supplier list.
iii. Operation and maintenance requirements/instructions for special light fixtures (these fixtures to be determined by A/E) including:
a) installation/removal instructions
b) special re-lamping instructions
iv. Parts list.

z. Section 26 56 00, “Exterior Lighting”
i. Product data and/or catalog sheets on all equipment applicable to this project.
ii. Equipment supplier list.
iii. Operation and maintenance requirements/instructions for special light fixtures

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(these fixtures to be determined by A/E) including:

a) installation/removal instructions

b) special re-lamping instructions

iv. Parts list.

8. Division 27

a. Section 27 41 00, “Audio Video Systems”

i. For each system; name, address, phone, cell, fax, email:

a) Installer

b) Authorized representative

c) Equipment supplier

ii. Product data and/or catalog sheets on equipment applicable to this project.

iii. Parts list.

iv. Wiring diagrams of panels.

v. Shop drawings as submitted and accepted in submittal process.

b. Section 27 41 33, “Local Area Sound System - Media Center”

i. For each system; name, address, phone, cell, fax, email:

a) Installer

b) Authorized representative

c) Equipment supplier

ii. Product data and/or catalog sheets on equipment applicable to this project.

iii. Parts list.

iv. Wiring diagrams of panels.

v. Shop drawings as submitted and accepted in submittal process.

c. Section 27 51 16, “Intercom System”

i. For each system; name, address, phone, cell, fax, email:

a) Installer

b) Authorized representative

c) Equipment supplier

ii. Product data and/or catalog sheets on equipment applicable to this project.

iii. Parts list.

iv. Wiring diagrams of panels.

v. Shop drawings as submitted and accepted in submittal process.

d. Section 27 53 13, “GPS Wireless Clock Systems”

i. For each system; name, address, phone, cell, fax, email:

a) Installer

b) Authorized representative

c) Equipment supplier

i. Product data and/or catalog sheets on equipment applicable to this project.

ii. Parts list.

iii. Wiring diagrams of panels.

iv. Shop drawings as submitted and accepted in submittal process.

9 Division 28

a. Section 28 13 10, “Access Control System”

i. For each system; name, address, phone, cell, fax, email:

1. Installer
2. Authorized representative

ii. Product data and/or catalog sheets on equipment applicable to this project.

iii. Parts list.

iv. Wiring diagrams of panels.

v. Shop drawings as submitted and accepted in submittal process.

b. Section 28 16 00, “Intrusion Detection System”

i. For each system; name, address, phone, cell, fax, email:

1. Installer
2. Authorized representative

ii. Product data and/or catalog sheets on equipment applicable to this project.

iii. Parts list.

iv. Wiring diagrams of panels.

v. Shop drawings as submitted and accepted in submittal process.

c. Section 28 20 00, “Camera Surveillance System”

i. For each system; name, address, phone, cell, fax, email:

1. Installer
2. Authorized representative

ii. Product data and/or catalog sheets on equipment applicable to this project.

iii. Parts list.

iv. Wiring diagrams of panels.

v. Shop drawings as submitted and accepted in submittal process.

d. Section 28 31 00, “Addressable Fire Alarm-Detection System”

i. For each system; name, address, phone, cell, fax, email:

1. Installer
2. Authorized representative

ii. Product data and/or catalog sheets on equipment applicable to this project.

iii. Parts list.

iv. Wiring diagrams of panels.

v. Shop drawings as submitted and accepted in submittal process.

e PROCESSING SUBMITTALS.

i. Refer to Division 1 General Requirements.

f DELAYS

i. Contractor is responsible for delays in job projects accruing directly or indirectly from late submissions or resubmissions of shop drawings, or product data.

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g RESUBMITTALS

i. The A/E shall be reimbursed cost to review resubmittals subsequent to the second submittal.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION

EXHIBIT A

PROJECT INFORMATION SHEET

School: _____

Project Name: _____

Project Number: _____

Substantial Completion Date: _____

Certificate of final Completion Date: _____

	Name & Address	Phone/Fax	Contact
Martin County School District Authorized Construction Representative			
Architect			
Mechanical Engineer			
Electrical Engineer			
Civil Engineer			
Structural Engineer			
Food Service Consultant			
Other Consultant(s)			

Brief Description of Project Scope:

_____

_____

_____

_____

_____

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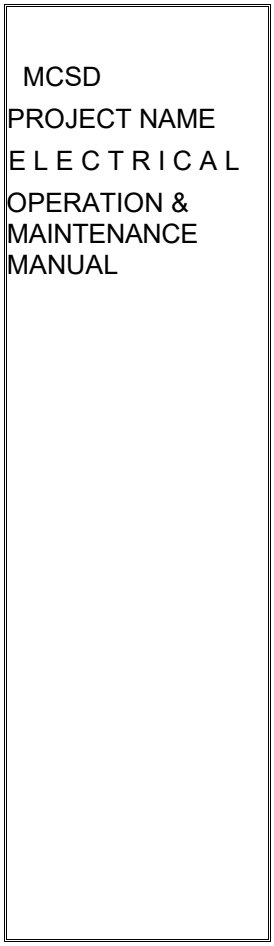
EXHIBIT B

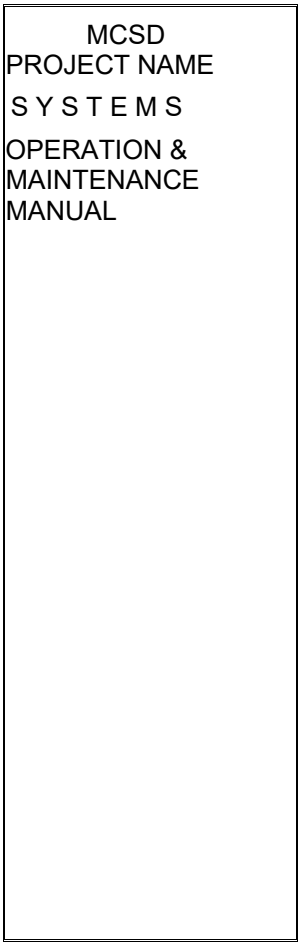
MANUAL COVER (face)

MARTIN COUNTY SCHOOL DISTRICT STUART, FLORIDA PROJECT NAME OPERATION AND MAINTENANCE MANUAL DATE (substantial completion date)	MARTIN COUNTY SCHOOL DISTRICT STUART, FLORIDA PROJECT NAME OPERATION AND MAINTENANCE MANUAL DATE (substantial completion date)

EXHIBIT C

MANUAL COVER (spine)





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EXHIBIT D

SPARE PARTS / MAINTENANCE STOCK CERTIFICATION

This form verifies that the parts/stock listed below has been delivered to and received by Martin County School District Maintenance. Original shall be included in the Closeout Documentation Manual. Copies shall also be included in the O & M Manual.

Project Name:

Type/Name of Spare Parts/Attic Stock:

Specification Reference:

Quantity of Spare Parts/Attic Stock:

Signature below by the Contractor and Subcontractor signifies that the spare parts/maintenance stock, required by the Contract Documents, have been delivered to the Owner.

Contractor/CM

Date:

Authorized Signature, Title

Subcontractor

Date:

Authorized Signature, Title

Signature by the Owner acknowledges receipt of the same spare parts/maintenance stock.

Martin County School District - Department

Date:

Authorized Signature, Title CHECK OUT MEMO

Check Out Memo shall be completed and a copy provided to the Owner at the Owner's Performance Verification and Demonstration meeting. A copy shall also be included in the specification section of each O & M Manual for the equipment checked.

Project Name

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Type of Equipment Checked

Equipment Number

Name of Manufacturer of Equipment

Signature below by the manufacturer's authorized representative signifies that the equipment has been satisfactorily tested and checked out on the job by the manufacturer.

1. The attached Test and Data and Performance Verification information was used to evaluate the equipment installation and operation.
2. The equipment is properly installed, has been tested by the manufacturer's authorized representative, and is operating satisfactorily in accordance with all requirements, except for items noted below. *
3. Written operating and maintenance information has been presented and reviewed in detail with the Contractor.
4. Sufficient copies of all applicable operating and maintenance information, parts lists, lubrication checklists, and warranties have been furnished to the Contractor for insertion in the Operation and Maintenance Manuals.

CHECKED BY:

MANUFACTURER'S REPRESENTATIVE – PRINT NAME

ADDRESS

TELEPHONE, FAX, E-MAIL

MANUFACTURER'S REPRESENTATIVE – SIGNATURE AND TITLE

DATE CHECKED

WITNESSED BY:

CONTRACTOR'S REPRESENTATIVE – SIGNATURE AND TITLE

*EXCEPTIONS NOTED AT TIME OF CHECK-OUT (USE ADDITIONAL PAGE IF NECESSARY)

CONDUCTOR INSULATION RESISTANCE TEST MEMO

PROJECT NAME

CONDUCTOR FROM_____TO

SIZE

INSULATION TYPE

INSULATION VOLTAGE

RATING

DATE TIME

WEATHER

CONDITIONS

TEST VOLTAGE (DC)

RANGE

MEGGER INSTRUMENT/SERIAL

NUMBER

TESTING METHODOLOGY

INSULATION RESISTANCE MEASUREMENT (ACCEPTABLE MEASUREMENT NOT TO BE LESS THAN (1) MEGOHM):

PHASE A TO GROUND

PHASE B TO GROUND

PHASE C TO GROUND

NEUTRAL TO GROUND

ISOLATED GROUND TO GROUND

CONTRACTOR'S REPRESENTATIVE

DATE

OWNER'S REPRESENTATIVE:

DATE:

ENGINEER'S REPRESENTATIVE:

DATE:

GROUND TEST INFORMATION

PROJECT NAME:

GROUND TYPE:

TEST BY:

DATE OF TEST:

GROUND LOCATION:

GROUND TYPE (Rod, Water pipe, etc.):

PRIOR TO CONNECTION TO SYSTEM
GROUND _____(OHMS)
AFTER CONNECTION TO SYSTEM
GROUND _____(OHMS)
WEATHER CONDITIONS (Wet/Dry)_____
SOIL CONDITIONS (Wet/Dry) _____
CONTRACTOR'S REPRESENTATIVE
_____
DATE _____

ENGINEER'S REPRESENTATIVE
_____
DATE _____
OWNER'S REPRESENTATIVE
_____
DATE_____
VOLTAGE AND AMPERAGE READINGS (TABULATED DATA)
PROJECT NAME
_____
SWITCHGEAR/PANELBOARD
_____
FULL-LOAD AMPERAGE READINGS: DATE __
TIME _____
PHASE A _____
B_____ C__ N_____ GROUND ____
FULL LOAD VOLTAGE READINGS: DATE ____
TIME _____
PHASE A TO N_____A TO B _____ B TO N____A TO C _____
C TO N_____B TO C _____
VOLTAGE AT THE END OF THE LONGEST BRANCH
_____

TYPE OF LOAD
_____

NO LOAD VOLTAGE READINGS: DATE_____
TIME _____
PHASE A TO N_____A TO B _____ B TO N__A TO C _____
C TO N_____B TO C _____
ENGINEER'S REPRESENTATIVE
_____

DATE _____

OWNER'S AUTHORIZED REPRESENTATIVE

_____

DATE _____

CONTRACTOR'S REPRESENTATIVE

_____

DATE _____

PROGRESS AND RECORD DRAWING CERTIFICATION

NAME OF PROJECT:

_____

DIVISION NUMBER AND NAME:

_____

This is to certify that the attached marked-up design prints were marked as the items were installed at the site during construction, and that these prints represent as accurate "As-Builts" record of the work as actually installed. One copy will be turned over to the Owner at the instruction in Operation Conference. The duplicate copy is for the Engineer's files.

_____

General Contractor

_____

By: Authorized Signature and Title

_____

Date

_____

Subcontractor

_____

By: Authorized Signature and Title

_____

Date

_____

SECTION 26 05 00 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the sections included under Division 1, General Requirements, are included as a part of this section as though bound herein.

B. The requirements in this section of the specification are in addition to all requirements in sections referenced above.

1.2 SUMMARY

A. This section includes Basic Electrical Requirements specifically applicable to Division 26 Sections, in addition to Division 1 - General Requirements - and any supplemental requirements/conditions.

1.3 DESCRIPTION OF WORK

A. The work required under this Division shall include all materials, labor and auxiliaries required to install a complete and properly operating electrical system.

B. The Contractor shall furnish, perform, or provide all labor including planning, purchasing, transporting, storing, installing, testing, cutting and patching, trenching, excavating, backfilling, coordination, field verification, equipment (installation and safety), supplies, and materials necessary for the correct installation of complete electrical systems (as described or implied by these specifications and the applicable drawings) in strict accordance with applicable codes, which may not be repeated in these specifications, but are expected to be common knowledge of qualified Bidders.

C. The Division 26 Contract Documents refer to work required in addition to (or above) the minimum requirements of the NEC 2020. Edition and applicable local codes. All work shall comply with all applicable codes as a minimum and with the additional requirements called for in these Contract Documents.

D. Only trained and licensed personnel shall be used by the Contractor to perform work. The Contractor shall not perform work, which violates applicable Codes, even if called for in the Contract Documents. The Contractor's Bid shall include work necessary to completely install the electrical systems indicated by the Contract Documents in accordance with applicable Codes.

E. Refer to other Division 26 Sections for additional work requirements.

F. Coordinate and verify power and telephone company service requirements prior to bid. Bid to include all work required for complete and properly operating systems.

G. Connections of all items using electric power shall be included under this division of the specifications, including necessary wire, conduit, circuit protection, disconnects and accessories. Securing of roughing-in drawings and connection information for equipment involved shall also be included under this division. See other divisions for specifications for electrically operated equipment.

H. The Contractor shall provide and install panic hardware on all electrical room doors where the electrical room houses equipment rated 1200 amps or more per NEC 110.26. All electrical room doors shall open in the direction of egress.

1.4 WORK SEQUENCE

A. Install work in stages and/or phases to accommodate Owner's occupancy requirements. Coordinate electrical schedule and operations with Owner and Architect/Engineer.

1.5 CODES, FEES, AND STANDARDS

A. Obtain permits and request inspections from authority having jurisdiction and applicable utility companies.

B. Pay for all required licenses, fees, and inspections.

C. Contact the Utility Companies to determine if fees, charges or costs are required by the Utility Company for permanent power and for temporary power, installations and hook-ups. These fees, charges or costs shall be included in Contractor's bid.

D. Material shall be new and free of defects with UL listing or be listed with an approved, nationally recognized Electrical Testing Agency if and only if UL Listing is not available for material.

1.6 PROJECT/SITE CONDITIONS

A. Install Work in locations shown or described in the Contract Documents, unless prevented by Project conditions.

B. The Contractor shall install all equipment so that all Code required, and Manufacturer recommended servicing clearances are maintained. Contractor shall be responsible for the proper arrangement and installation of all equipment within any designated space. Should the Contractor determine that a departure from the Contract Documents is necessary, he shall submit to the A/E, for approval, detailed drawings of his proposed changes with his written reasons for the changes. No changes shall be implemented by the Contractor without the issuance of the required drawings, clarifications, and/or change orders.

C. The Contractor shall verify finish dimensions at the project site in preference to using dimensions noted on Contract Documents.

1.7 CONTRACT DOCUMENTS

A. These specifications and applicable drawings shall be considered supplementary, one to the other and are considered Contract Documents. All workmanship, methods, and/or material described or implied by one and not described or implied by the other shall be furnished, performed, or otherwise provided just as if it had appeared in both sets of documents.

B. Where a discrepancy or conflict is found between these specifications and any applicable drawing, the Contractor shall notify the A/E in written form. In the event that a discrepancy exists between specifications and any applicable drawing, the most stringent requirement shall govern unless the discrepancy conflicts with applicable codes wherein the code shall govern. The most stringent requirement shall be that work, product, etc. which is the most expensive and costly to implement.

C. The drawings are diagrammatic and are not intended to include every detail of construction, materials, methods, and equipment. They indicate the result to be achieved by an assemblage of various systems. Coordinate equipment locations with Architectural and Structural drawings. Layout equipment before installation so that all trades may install equipment in spaces available. Coordinate installation in a neat and workmanlike manner.

D. Wiring arrangements for equipment shown on the drawings are intended to be diagrammatic and do not show all required conductors and functional connections. All wiring and appurtenances required for the proper operation of all equipment to be connected shall be provided.

E. Specifications require the Contractor to provide shop drawings which shall indicate the fabrication, assembly, installation, and erection of a particular system's components. Drawings that are part of the Contract Documents shall not be considered a substitute for required shop drawings, field installation drawings, Code requirements, or applicable standards.

F. Locations indicated for outlets, switches, and equipment are approximate and shall be verified by instructions in specifications and notes on the drawings. Where instructions or notes are insufficient to locate the item, notify the A/E.

G. The Contractor shall take finish dimensions at the project site in preference to scaling dimensions on the drawings.

H. Where the requirements of another Division, section, or part of these specifications exceed the requirements of this Division, those requirements shall govern.

1.8 MATERIALS AND EQUIPMENT

A. Material shall be new (except where specifically noted, shown or specified as "Reused") and/or denoted as existing) and shall be UL listed and bear UL label. Where no UL label listing is available for a particular product, material shall be listed with an approved, nationally recognized Electrical Testing Agency. Where no labeling or listing service is available for certain types of equipment, test data shall be submitted to prove to the Engineer that equipment meets or exceeds available standards.

B. Where Contract Documents list design selection or manufacturer, type, this model shall set the standard of quality and performance required. Where no brand name is specified, the source and quality shall be subject to A/E's review and acceptance. Where Contract Documents list accepted substitutions, these items shall comply with requirements in Division 01.

C. When a product is specified to be in accordance with a trade association or government standard and at the request of A/E the Contractor shall furnish a certificate that the product complies with the referenced standard and supporting test data to substantiate compliance.

D. Where multiple items of the same equipment or materials are required, they shall be the product of a single Manufacturer.

E. Where the Contract Documents require materials and/or equipment installed, pulled, or otherwise worked on, the materials and/or equipment shall be furnished and installed by the Contractor responsible for Division 26 methods and materials unless specifically noted otherwise.

F. Where the contract documents refer to the terms "furnish," "install," or "provide," or any combination of these terms) the materials and/or equipment shall be supplied and delivered to the project including all labor, unloading, unpacking, assembly, erection, anchoring, protecting supplies and materials necessary for the correct installation of complete system unless specifically noted otherwise.

G. Before the Contractor orders equipment, the physical size of specified equipment shall be checked to fit spaces allotted on the drawings, with NEC working clearances provided. Internal access for proposed equipment substitutions shall be provided.

H. Electrical equipment shall be protected from the weather, during shipment, storage, and construction per manufacturer's recommendations for storage and protection. Should any apparatus be subjected to possible damage by water, it shall be thoroughly dried and put through a dielectric test, at the expense of the Contractor, to ascertain the suitability of the apparatus, or it shall be replaced without additional cost to the Owner. No additional time will be allowed, and the project completion date shall be maintained.

I. Inspect all electrical equipment and materials prior to installation. Damaged equipment and materials shall not be installed or placed in service. Replace or repair and test damaged equipment in compliance with industry standards at no additional cost to the Owner. Equipment required for the test shall be provided by the Contractor.

J. Material and equipment shall be provided completely and shall function up to the specified capacity/function. Should any material and/or equipment as a part or as a whole fail to meet performance requirements, replacements shall be made to bring performance up to specified requirements. Damages to finish by such replacements, alterations, or repairs shall be restored to prior conditions, at no additional cost to the Owner.

K. Where tamperproof screws are specified or required, Phillips head or Allen head devices shall not be accepted. For each type used, provide Owner with three tools. Owner will designate the specific hardware design to correspond with existing devices elsewhere in the building, to limit special tool requirements.

L. Where the Contract Documents denote equipment and/or material to be 'new' and/or 'existing' and also provide no denotation for other equipment as to it being 'new' and/or 'existing,' this is not to infer that the non-denoted equipment is either new or existing, or opposite of the equipment that is denoted. The use of the terms 'new' or 'existing' is meant to clarify denoted equipment/materials for that item only, and the lack of the terms 'new' or 'existing' in relation to

identifiers/notes/denotations on the drawings is not to infer that this non-denoted equipment or materials is new or existing.

1.9 MISCELLANEOUS CIRCUITS REQUIRED

A. Provide 120-volt, 20-amp circuit to post indicator valves (whether shown on drawings or not). Connect to spare 20-amp, 1 pole circuit breaker in nearest 120-volt panel. Re-label circuit breaker accordingly. Provide locking device on breaker. Coordinate location with civil engineer (and drawings/specifications) or fire protection engineer (and drawings/specifications) prior to bid and provide all electrical. Coordinate final location and electrical requirements with valve installer after bid and provide all electrical. Nearest panel to be nearest emergency panel, when building has emergency generator system.

B. Provide 120-volt, 20-amp circuit to fire protection system panel and bell (whether shown on drawings or not). Connect to spare 20-amp, 1 pole circuit breaker in nearest 120-volt panel. Re-label circuit breaker accordingly. Provide locking device on breaker. Coordinate location with civil engineer (and drawings/specifications) or fire protection engineer (and drawings/specifications) prior to bid and provide all electrical. Coordinate final location and electrical requirements with panel installer after bid and provide all electrical. Nearest panel to be nearest emergency panel, when building has emergency generator system.

C. Provide 120-volt, 20-amp circuit to intercom system panel (whether shown on drawings or not). Connect to spare 20-amp, 1 pole circuit breaker in nearest 120-volt panel. Re-label circuit breaker accordingly. Provide locking device on breaker. Coordinate location with intercom system engineer (and drawings/specifications) prior to bid and provide all electrical. Coordinate final location and electrical requirements with panel installer after bid and provide all electrical. Nearest panel to be nearest emergency panel, when building has emergency generator system.

D. Provide 120-volt, 20-amp circuit to all fire alarm panels, remote panels, etc. (whether shown on drawings or not). Connect to spare 20-amp, 1 pole circuit breaker in nearest 120-volt panel. Re-label circuit breaker accordingly. Provide locking device on breaker. Coordinate location with fire alarm system engineer (and drawings/specifications) prior to bid and provide all electrical. Coordinate final location and electrical requirements with panel installer after bid and provide all electrical. Nearest panel to be nearest emergency panel, when building has emergency generator system.

E. Provide 120-volt, 20-amp circuit to fire and smoke dampers (whether shown on drawings or not). Connect to spare 20-amp, 1 pole circuit breaker in nearest 120-volt panel. Re-label circuit breaker accordingly. Provide locking device on breaker. Coordinate location with fire protection engineer (and drawings/specifications) prior to bid and provide all electrical. Coordinate final location and electrical requirements with damper installer after bid and provide all electrical. Nearest panel to be nearest emergency panel, when building has emergency generator system.

F. Provide 120-volt, 20-amp circuit to building control panels for HVAC system (whether shown on drawings or not). Connect to spare 20-amp, 1 pole circuit breaker in nearest 120-volt panel. Re-label circuit breaker accordingly. Provide locking device on breaker. Coordinate location with fire protection engineer (and drawings/specifications) prior to bid and provide all electrical. Coordinate final location and electrical requirements with damper installer after bid and provide all electrical

1.10 SUPERVISION OF THE WORK

A. Reference the General Conditions for additional requirements.

B. The Contractor shall provide experienced, qualified, and responsible supervision for work. A competent foreman shall be in charge of the work in progress at all times. If, in the judgment of the A/E, the foreman is not performing his duties satisfactorily, the Contractor shall immediately replace him upon receipt of a letter of request from the A/E. Once a satisfactory foreman has been assigned to the work, he shall not be withdrawn by the Contractor without the written consent of the A/E.

C. Provide field superintendent who has had a minimum of four (4) years' previous successful experience on projects of comparable size and complexity. Superintendent shall be on the site at all times during construction and must have an active Journeyman's Electrical License.

D. Superintendent shall be employed by a Florida Registered Electrical Contractor (ER) or Florida Certified Electrical Contractor (EC).

1.11 COORDINATION

A. Provide all required coordination and supervision where work connects to or is affected by work of others and comply with all requirements affecting this Division. Work required under other divisions, specifications, or drawings to be performed by this Division shall be coordinated with the Contractor and such work performed at no additional cost to Owner including but not limited to electrical work required for:

1. Door Hardware
2. Roll-up doors
3. Fire shutters
4. Roll-up grilles
5. Elevators
6. Mechanical Division of the Specifications
7. Landscape Architect drawings
8. Kitchen Equipment
9. Millwork design drawings and shop drawings

B. Contractor shall obtain set of contract documents from Owner for all areas of work noted above and include all electrical work in bid whether included in Divisions 26, 27 or 28 Contract Documents or not.

C. Installation studies shall be made to coordinate the electrical work with other trades. Work shall be preplanned. Unresolved conflicts shall be referred to the A/E prior to installation of the equipment.

D. For locations where several elements of electrical or combined mechanical and electrical work must be sequenced and positioned with precision in order to fit into the available space, prepare coordination drawings at 1/4" scale showing the actual physical dimension required for the installation to assure proper integration of equipment with building systems and NEC required clearances. Coordination drawings shall be provided for all areas determined by the A/E.

E. Secure accepted shop drawings from all required disciplines and verify final electrical characteristics before roughing power feeds to any equipment. When electrical data on accepted shop drawings differs from that shown or called for in Construction Documents, make adjustments to the wiring, disconnects, and branch circuit protection to match that required for the equipment installed.

F. Damage from interference caused by inadequate coordination shall be corrected at no additional cost to the Owner and the contract time for completion will not be extended.

G. The Contractor shall maintain an up-to-date set of Contract Documents and Specifications of all trades on the project site, including Architectural, Structural, Mechanical, Electrical and, where provided Interior Design Drawings.

H. It is the responsibility of this Contractor to coordinate the exact required location of floor outlets, floor ducts, floor stub-ups, etc. with Owner and Architect (and receive their written approval) prior to rough-in. Locations indicated in Contract Documents are approximate.

I. The Contract Documents describe specific sizes of switches, breakers, fuses, conduits, conductors, motor starters and other items of wiring equipment. These sizes are based on specific items of power consuming equipment (heaters, lights, motors for fans, compressors, pumps, etc.). The Contractor shall coordinate the requirements of each load with each load's

respective circuitry shown and with each load's requirements as noted on its nameplate data and manufacturer's published electrical criteria. The Contractor shall adjust circuit breaker, fuse, conduit, and conductor sizes to meet the actual requirements of the equipment being provided and installed and change from single point to multiple points of connection (or vice versa) to meet equipment requirements. Changes due to these coordination efforts shall be made at no additional cost to the Owner.

1.12 PROVISION FOR OPENINGS

A. Locate openings required for work. Provide sleeves, guards, or other accepted methods to allow passage of items installed.

B. Coordinate with roofing Contractor on installation of electrical items which pierce roof. Roof penetrations shall not void warranty. The use of pitch pockets is not acceptable.

C. Where work pierces waterproofing, it shall maintain the integrity of the waterproofing. Coordinate roofing materials which pierce roof for compatibility with membrane or other roof types with Contractor prior to installation.

1.13 CONCRETE PADS

A. Furnish and install reinforced concrete housekeeping pads for transformers, switchgear, motor control centers, and other free-standing equipment. Unless otherwise noted, pads shall be four (4) inches high and shall exceed dimensions of equipment being set on them, including future sections, by six (6) inches each side, except when equipment is flush against a wall where the side against the wall shall be flush with the equipment. Pads shall be reinforced with W1.4 x 1.4 6 x 6 welded wire mesh. Chamfer top edges 1/2". Trowel all surfaces smooth. Provide 3000 psi concrete.

B. Contractor to provide/install concrete pad for exterior pad mount transformers as required by Power Company.

1.14 SURFACE MOUNTED EQUIPMENT

A. Surface mounted fixtures, outlets, cabinets, conduit, panels, etc. shall have finish as directed by Engineer.

1.15 CUTTING AND PATCHING

A. New Construction:

1. Reference Division 1 - General Requirements.
2. Cutting of work in place shall be cut, drilled, patched and refinished by trade responsible for initial installation.
3. The Contractor shall be responsible for backfilling and matching new grades with adjacent undisturbed surface.

1.16 TRENCHING

A. Trench excavation in excess of 5 feet deep shall comply with OSHA Standard 29 CFRs. 1926. 650 Subpart P.

1.17 INSTALLATION

A. Erect equipment to minimize interferences and delays in execution of the work.

B. Take care in erection and installation of equipment and materials to avoid marring finishes or surfaces. Any damage shall be repaired or replaced as determined by the A/E at no additional cost to the Owner.

C. Equipment requiring electrical service shall not be energized or placed in service until A/E is notified and is present or have waived their right to be present in writing. Where equipment to be placed in service involves service or connection from another Contractor or the Owner, the Contractor shall notify the Owner in writing when the equipment will be ready. The Owner shall be notified as far in advance as possible of the date the various items of equipment will be complete.

D. Equipment supports shall be secured and supported from structural members except as field accepted by the A/E in writing.

E. Plywood material shall not be used as a backboard for mounting panel boards, disconnects, motor starters, and dry type transformers. Provide "cast in place" type inserts or install expansion type anchor bolts. Electrical equipment shall not be mounted directly to dry wall for support without additional channels as anchors. Channels shall be anchored to the floor and structure above. Panelboards and terminal cabinets shall be provided with structural framing located within drywall partitions.

F. The Contractor shall keep the construction site clean of waste materials and rubbish. Upon completion of the work, the Contractor shall remove from the site all debris, waste, unused materials, equipment, etc.

G. Inserts, pipe sleeves, supports, and anchorage of electrical equipment shall be provided. Where items are to be set or embedded in concrete or masonry, the items shall be furnished, and a layout made prior to the setting or embedment thereof, so as to cause no delay.

1.18 PROGRESS AND RECORD DRAWINGS

A. Keep two sets of blueline prints on the job, and neatly markup design drawings each day as components is installed. Different colored pencils shall be used to differentiate each system of electrical work. Cost of prints and this labor task shall be included under this Division. All items on Progress Drawings shall be shown in actual location installed. Change the equipment schedules to agree with items actually furnished.

B. Prior to request for substantial completion observation, furnish a set of neatly marked prints showing "as-installed" (as-built) condition of all electrical installed under this Division of the specifications. Marked up prints are to reflect all changes in work including change orders, field directives, addenda from bid set of Contract Documents, request for information responses, etc. Marked up set of prints are to show:

1. All raceways 1-1/2 inch and above, exactly as installed.
2. All site raceways exactly as installed.
3. Any combining of circuits (which is only allowed by specific permission) or change in homerun outlet box shall be made on as-builts.
4. Any circuit number changes on plan shall be indicated on as-builts.
5. Any panelboard schedule changes shall be indicated on as-builts.

C. Marked up prints as noted above are to be submitted to A/E for acceptance. Contractor shall review submitted "as-builts" with Engineer in the field. Contractors shall verify every aspect for accuracy.

D. After acceptance of marked up prints by A/E with all changes, additions, etc. included on accepted marked up prints, submit prior to request for final payment and/or request for final observation.

E. Where the Contractor has failed to produce representative "as-built" drawings in accordance with requirements specified herein, the Contractor shall reimburse Engineer all costs to produce a set of "as-built" drawings to the Architect/Owner satisfaction.

1.19 "OBSERVATION OF WORK" REPORT

A. Reference the General Conditions.

B. Items noted by A/E or his representative during construction and before final acceptance which do not comply with the Contract Documents will be listed in an "Observation of Work" report which will be sent to the Contractor for immediate action. The Contractor shall correct all deficiencies in a prompt concise manner. After completion of the outstanding items, provide a written confirmation report for each item. The report shall indicate each item noted, and method of correction. Enter the date on which the item was corrected and return the signed reports so items can be

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rechecked. Failure to correct the deficiencies in a prompt concise manner or failure to return the signed reports shall be cause for disallowing request for payments.

C. Items noted after acceptance during one-year guarantee period shall be checked by the Contractor in the same manner as above. The signed reports are to be returned by him when the items have been corrected.

1.20 TRAINING OF OWNERS OPERATORS: (Refer to Appendix A)

A. The owners shall be given comprehensive training in the understanding of the systems and operation and maintenance of each major piece of equipment.

B. The contractor shall be responsible for scheduling the training which shall start with classroom sessions followed by hands on training on each piece of equipment. Hands on training shall include start-up, operation in all modes possible, shutdown and any emergency procedures.

C. The manufacturer’s representative shall provide the instructions on each major piece of equipment. These sessions shall use the printed installation, operation and maintenance instruction material included in the O&M manuals and shall emphasize safe and proper operating requirements and preventative maintenance.

1.21 SYSTEMS WARRANTY

A. Reference the General Conditions.

B. The work shall include a one-year warranty. This warranty shall be by the Contractor to the Owner for any defective workmanship or material which has been furnished at no cost to the Owner for a period of one year from the date of substantial completion of System. Warranty shall not include light bulbs in service after one month from date of substantial completion of the System. Explain the provisions of warranty to the Owner at the "Demonstration of Completed System" meeting to be scheduled with the Owner upon project completion.

C. Where items of equipment or materials carry a manufacturer's warranty for any period in excess of 12 months, then the manufacturer's warranty shall apply for that particular piece of equipment or material.

D. Where extended Warranty or Guarantees are called for herein, furnish three copies to be inserted in Operation and Maintenance Manuals.

E. All preventative maintenance and normal service will be performed by the Owner's maintenance personnel after final acceptance of the work, which shall not alter the Contractor's warranty.

1.22 WASTE MATERIALS DISPOSAL

A. Contractor shall include in his bid the transport and disposal or recycling of all waste materials generated by this project in accordance with all rules, regulations, and guidelines applicable. Contractor shall comply fully with Florida statute 403.7186 regarding mercury containing devices and lamps. Lamps, ballasts, and other materials shall be transported and disposed of in accordance with all DEP and EPA guidelines applicable at time of disposal. Contractor shall provide owner with written certification of accepted disposal.

1.23 SUBSTANTIAL COMPLETION

A. The Contractor shall be fully responsible for contacting all applicable parties to schedule required observations of the work by Engineer.

B. Work shall be complete as required by authorities having jurisdiction and the general conditions of the contract prior to request for substantial completion observation. Work must be deemed substantially complete by A/E to fulfill requirements.

1.24 PROHIBITION OF ASBESTOS AND PCB

A. The use of any process involving asbestos or PCB, and the installation of any product, insulation, compound of material containing or incorporating asbestos or PCB, is prohibited. The requirements of this specification for complete and operating electrical systems shall be met without the use of asbestos or PCB.

B. Prior to the Final Review field visit, the Contractor shall certify in writing that the equipment and materials installed in this Project under this Division 26 contain no asbestos or PCB's. Additionally, all manufacturers shall provide a statement with their submittal that indicates that their product contains no asbestos or PCB's. This statement shall be signed and dated by a duly authorized agent of the manufacturer.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

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APPENDIX A

Training Schedule

Div.	Training Description	Subcontractor	Demo Date	Time	Hours	Comments	Personnel to attend training
	Premise Distribution System IT Network/Data				4 hours	Familiarize the owner with the locations of all TR's, cable and jack labeling and numbering systems, data and voice connections.	
	Electrical Systems				2-4 hour	Complete overview of all electrical systems. See specifications for list of essential features to be demonstrated, include generator.	
	Occupancy Sensors				4 hours	Demonstrate to owner selected personnel proper operation and maintenance of all related equipment.	
	Local Area Sound System-Media Center				4 hours	Demonstrate to owner selected personnel proper operation and maintenance of all related equipment.	
	Audio Video Systems				2-4 hour	Demo system operation and provide a 2-hour videotaped instruction with manufacture's training personnel to school personnel upon all aspects of the CATV system from the head-end to the user TV.	
	School Intercom System				2-4 hour	Demonstrate to owner selected personnel proper operation and maintenance of all related equipment.	

	Wireless Clock System				2 hours	Demonstrate to owner selected personnel proper operation and maintenance of all related equipment.	
	Access Control System				4 hours	Demonstrate to owner selected personnel proper operation and maintenance of all related equipment.	
	Intrusion Detection				2-4 hour	Demonstrate to owner selected personnel proper operation and maintenance of all related equipment.	
	Camera Surveillance				2-4 hour	Demonstrate to owner selected personnel proper operation and maintenance of all related equipment.	
	Addressable Fire Alarm Detection System				2-4 hour	Demonstrate to owner selected personnel proper operation and maintenance of all related equipment.	

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SECTION 26 05 03 - EQUIPMENT WIRING SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION OF SYSTEM

A. Provide and install all equipment, labor, material, accessories, and mounting hardware for a complete operating system for the following:

1. Electrical connections to equipment specified under other sections.

1.2 RELATED SECTIONS

A. Summary of Work

B. Conduit.

C. Building Wire and Cable.

D. Boxes.

E. Electric Doors.

1.3 REFERENCES

A. NEMA WD 1 - General Requirements for Wiring Devices

B. NEMA WD 6 - Wiring Devices-Dimensional Requirements

C. ANSI/NFPA 70 - National Electrical Code.

1.4 SUBMITTALS

A. Submit under provisions of the General Requirements of the Contract Documents and Section Submittals.

1.5 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.6 COORDINATION

A. Obtain and review shop drawings, product data, and manufacturer's instructions for equipment furnished under other sections.

B. Determine connection locations and requirements.

C. Sequence rough-in of electrical connections to coordinate with installation schedule for equipment.

D. Sequence electrical connections to coordinate with start-up schedule for equipment.

PART 2 - PRODUCTS

2.1 CORDS AND CAPS

A. Attachment Plug Construction: Conform to NEMA WD 1.

B. Configuration: NEMA WD 6; match receptacle configuration at outlet provided for equipment.

C. Cord Construction: ANSI/NFPA 70, Type SO multi-conductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.

D. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify conditions under provisions of Section Investigation of Existing Electrical Systems.

B. Verify that equipment is ready for electrical connection, wiring, and energization.

3.2 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using flexible conduit. Use liquid tight flexible conduit with watertight connectors in damp or wet locations (including inside of coolers/freezers).

C. Make wiring connections using wire and cable with insulation suitable for temperatures encountered in heat producing equipment and in cooler/freezers.

D. Provide receptacle outlet where connection with attachment plug is required. Provide cords and cap where field-supplied attachment plug is required.

E. Provide suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

F. Install disconnect switches, controllers, control stations, and control devices as required.

G. Modify equipment control wiring with terminal block jumpers as required.

H. Provide interconnecting conduit and wiring between devices and equipment where required.

I. Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings.

3.3 EQUIPMENT CONNECTION SCHEDULE

A. By local authority and as required for a complete operating service.

B. Electric Door(s):

1. Electrical Connection: liquid tight flexible conduit with local field installed disconnect switch and field installed control switch.
2. Voltage: 120 volts, 1 phase, 60 Hz.
3. Load rating: 1/2 hp.

C. CCTV Equipment:

1. Electrical Connection: Wiremold plug strips as required with surge suppression.
2. Voltage: 120 volts, 1 phase, 60 Hz.
3. 2 #10, plus ground, 3/4"c.
4. Use manual motor starter switch with overloads and with pilot light for disconnect switch.
5. Connect unit provided control switch as recommended by manufacturers. (3/4-inch c.)

END OF SECTION

SECTION 26 05 07 - SUBMITTALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

1.2 SUMMARY

A. Requirements for submittals specifically applicable to Division 26, 27, 28 Sections.

B. See Section Substitutions for additional requirements when submittal consists of accepted substitution equipment.

1.3 SUBMITTAL OF "ACCEPTED SUBSTITUTE" EQUIPMENT/PRODUCT

A. Representation: In submitting item, equipment, product, etc. that has been listed on contract drawings, in contract documents or in an addendum, Contractor represents that he:

1. Has investigated substituted item and has determined that it is equal or superior to specified product in all aspects and that use of substituted item will not require any additional time to the Contract.
2. Will coordinate installation of accepted substitution into work, making changes as may be required to complete work in all aspects.
3. Waives all claims for additional costs related to substitution which may subsequently become apparent.
4. Will provide the same warranties for the substitution as for the product specified.
5. Will absorb all costs incurred by the substitution when affecting other trades including but not limited to electrical, structural, architectural, etc.
6. Will absorb any cost incurred by the Engineer in review of the substituted product if the acceptance of the substituted item creates the need for system modification and/or redesign, or if the substituting contractor exhibits negligence in his substituting procedure thus submitting inferior, misapplied or miss-sized equipment. In the event of additional engineering costs, the billing structure shall be agreed upon prior to review by all involved parties.

B. Substitutions that cannot meet space requirements or other requirements of these Specifications, whether accepted or not, shall be replaced at the Contractor's expense with no additional time added to the Contract.

1.4 SUBMITTALS

A. Submittals shall be in electronic .pdf format with text searchable formatting.

B. Submittals to include:

1. First sheet shall be prepared and filled out by Contractor and shall list project addresses, telephones, etc.; see "PROJECT ADDRESSES" Form included at end of this section.
2. Second sheet shall be a copy of the Electrical Index pages in Specifications.
3. Provide separation sheets labeled with the appropriate specification reference number and typed index for each section in the Systems Schedule.
4. Submittals consisting of marked catalog sheets or shop drawings shall be inserted in the file in proper order. Submittal data shall be presented in a clear and thorough manner. Clearly mark each copy to identify pertinent products or models applicable to this project. Indicate all optional equipment and delete non-pertinent data. Markings shall be made with arrows, circles, or highlighting of clear specific model selections.

5. Shop Drawings: Drawings to include identification of project and names of Architect, Engineer, General Contractor, subcontractor and supplier, data, number sequentially and indicate the following:
    a. Fabrication and erection dimensions.
    b. Arrangements and sectional views.
    c. Necessary details, including complete information for making connections with other work.
    d. Kinds of materials and finishes.
    e. Descriptive names of equipment.
    f. Modifications and options to standard equipment required by the work.
    g. In order to facilitate review of drawings, insofar as practicable, they shall be noted, indicating by cross reference the contract drawings, note, and specification paragraph numbers where items occur in the Contract Documents.
    h. Conduit/raceway rough-in drawings (interior and exterior).
    i. Items requiring shop drawings include (but not limited to):
        i. Manual transfer switch
        ii. Light fixtures and lighting controls.
        iii. Each section of fire alarm, television, etc.
        iv. Wire, cable, and raceways.
        v. Wiring devices.
        vi. Special equipment
        vii. Main switchboard(s), panelboards, motor starters, VFDs, and disconnects.
        viii. UL listed fire and smoke stopping assemblies for each applicable penetration.
            a) See specific sections of Specifications for further requirements.
6. Product Data: Technical data is required for all items as called for in the Specifications regardless if item furnished is as specified.
    a. Submit technical data verifying that the item submitted complies with the requirements of the Specifications. Technical data shall include manufacturer's name and model number, dimensions, weights, electrical characteristics, and clearances required. Indicate all optional equipment and changes from the standard item as called for in the Specifications. Furnish drawings, or diagrams, dimensioned and in correct scale, covering equipment, showing arrangement of components and overall coordination.
    b. In order to facilitate review of product data, insofar as practicable, they shall be noted, indicating by cross reference the contract drawings, note, and/or specification paragraph numbers where and/or what item(s) are used for and where item(s) occur in the contract documents.
    c. See specific sections of Specifications for further requirements.

1.5 PROCESSING SUBMITTALS

A. Submit under provisions of the General Requirements of the Contract and this section of the Specifications, whichever is the strictest.

B. The Contractor shall review all submittals before submitting to the A/E. No request for payment will be considered until the submittals have been reviewed and submitted for approval.

C. Shop Drawing Review Notation:

Action	Description
No Exception Noted	No exceptions taken. Resubmittal not required.
Rejected	Not in compliance with Contract Documents. Resubmit
Submit Specific Item	Resubmit item as specified
Make Corrections Noted	Make corrections noted, resubmittal not required
Revise and Resubmit	Make corrections noted, resubmittal is required
Review Not Required	Not required for review
No Action Taken.	Copy retained for reference.

D. Acceptance: When returned to Contractor, submittals will be marked with A/E's stamp. If box marked "Rejected" "Revise and Resubmit" or "Submit Specific Item" is checked, submittal is not accepted and Contractor is to correct and resubmit as noted, otherwise submittal is accepted, and Contractor is to comply with notation making necessary corrections on submittal. Review comments will generally not be on each individual submittal sheet and will be on a separate sheet attached to shop drawing transmittal, submittal as a whole or each submittal section.

E. Note that the acceptance of shop drawings or other information submitted in accordance with the requirements specified above does not assure that the Engineer, Architect, or any other Owner's Representative, attests to the dimensional accuracy or dimensional suitability of the material or equipment involved, the ability of the material or equipment involved or the Mechanical/Electrical performance of equipment. Acceptance of shop drawings does not invalidate the plans and Specifications if in conflict the stringent and most costly requirement shall apply, unless a letter requesting such change is submitted and accepted on the Engineer's letterhead.

1.6 DELAYS

A. Contractor is responsible for delays in job progress, accruing directly or indirectly from late submissions or resubmissions of shop drawings, or product data.

1.7 RE-SUBMITTALS

A. The A/E shall be reimbursed for all costs to review resubmittals subsequent to the second submission for the same product. Cost will be billed to Contractor at Engineer's standard hourly rate.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION

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SECTION 26 05 08 - SUBSTITUTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section specifies general, administrative and procedural requirements for the substitutions for Divisions 26, 27, 28 above and beyond the requirements of Division 1 General Requirements and any Supplemental requirements/conditions.

B. Request for substitutions must be submitted no later than 10 days prior to bid due date.

C. Request for substitution will not be considered after bid due date.

1.3 DEFINITIONS

A. Definitions used in this Article are not intended to change or modify the meaning of other terms used in the Contract Documents.

B. Substitutions: Products, materials, equipment, finishes, and methods of construction are considered substitutions if they meet any one of the following conditions:

1. Does not meet all the requirements of these specifications under Part 1 - General or Part 2 - Products for any section included in Divisions 26, 27, 28.
2. Is a different design which accomplishes the same result as that design specified in Division 26 Sections.
3. Is of similar or different design that:
    a. Requires more space.
    b. Requires more power.
    c. Requires changes in other elements of the work such as (but not limited to) architectural, mechanical, structural, or other electrical work.
    d. Affects the construction schedule.
4. Is listed in these specifications on the Contract Documents or in any addenda as an accepted substitution.

1.4 REQUEST FOR SUBSTITUTION SUBMITTALS (10 Days Prior to Bid Due Date)

A. A separate request for substitutions shall be submitted for each product, material, etc. that is defined as a substitution.

B. Submittal must consist of written requests for substitutions with data as required below. Request must be very specific as to what specified item, request for substitution is submitted for.

C. Each request for substitution submittal for each product, etc. shall include:

1. Name of material or equipment for which it is to be substituted.
2. Drawings, product data, performance data and/or other information necessary for the engineer to determine that the equipment meets all specifications and requirements.
3. Proof that pole lighting fixture and pole meet applicable wind loading requirements. Pole lighting fixtures must be submitted showing proof that they comply with the applicable wind loading requirements for location of this project.
4. Compliance Statement. Each request shall include the following compliance statement typed on letterhead of submitting company:
    a. Submittal complies with all aspects/requirements of Contract Documents. (Yes or No). If no, state deviance.

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SECTION 26 05 09 - REFERENCE STANDARDS AND REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Reference Standards and Regulatory Requirements applicable to Divisions 26, 27 28 sections.

1.3 REFERENCES

A. The following references may be referenced within these specifications:

AASHTO	American Association of State Highway and Transportation Officials
ADA	Americans with Disabilities Act
AHERA	Asbestos Hazard Emergency Response Act
AIA	American Institute of Architects
ANSI	American National Standards Institute
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	ASME International American Society of Mechanical Engineers International
ASTM	American Society for Testing and Materials International
BOR	Board of Regents
BICSI	BICSI, Inc.
BOCC	Board of County Commissioners
CRSI	Concrete Reinforcing Steel Institute
DCA-ADAIA	Department of Community Affairs Florida Americans with Disabilities Accessibility Implementation Act
DCA-ADAAG	Department of Community Affairs Florida Americans with Disabilities Act Accessibility Guidelines
DCA-ARM	Department of Community Affairs Accessibility Requirements Manual
DER Rule 17-761	Department of Environmental Regulation Chapter 17-761 on Underground Storage Tank Systems
DER Rule 17-762	Department of Environmental Regulation, Chapter 17-762 on Above Ground Storage Tank Systems.
DMS/DOC	Department of Management Services Division of Communications
DOCA or DCA	State of Florida Department of Community Affairs
EIA/TIA	Electronics Industries Alliance/Telecommunications Industry Association
EJCDC	Engineers Joint Contract Documents Committee American Consulting Engineers Council
FAC	Florida Administrative Code
FBC	Florida Building Code
FCC	Federal Communications Commission

FEMA	Federal Emergency Management Agency
FFPC	Florida Fire Prevention Code
FGC	Florida Building Code (Fuel Gas)
FLA	State of Florida
FMC	Florida Building Code (Mechanical)
FMG	FM Global (formerly Factory Mutual System)
FPC	Florida Building Code (Plumbing)
FS	Florida Statutes
ICC	International Code Council
IEEE	Institute of Electrical and Electronics Engineers, Inc
IES	Illumination Engineering Society of North America
ICPEA	International Power Cable Engineer's Association
LPCR	Local Power Company Requirements
LPI	Lightning Protection Institute
LTCR	Local Telephone Company Requirements
NEC	National Electrical Code
NECPA	National Energy Conservation Policy Act
NESC	National Electrical Safety Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
OEF	Office of Educational Facilities
OSHA	Occupational Safety and Health Act
SBE	State Board of Education
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
UFSRS	Uniform Fire Safety Rules and Standards of Insurance Division of State Fire Marshal
UL	Underwriters Laboratories, Inc.
FBC	Florida Building Code Section 423 State Requirements for Educational Facilities

1.4 REGULATORY REQUIREMENTS

A. Conform to all the applicable requirements of the following codes, standards, guidelines, etc. If there should be conflicting requirements between these codes, standards, guidelines, etc., the more or most stringent requirement shall apply that does not violate any code or laws.

1. Standards and Miscellaneous Codes/Requirements (Comply with latest edition or notice available unless otherwise adopted by Authority Having Jurisdiction):
    a. Americans with Disabilities Act of 1990, as amended
    b. ADA Standards for Accessible Design, 2023
    c. American National Standards Institute
    d. American Society of Heating, Refrigerating and Air Conditioning Engineers
    e. American Society of Mechanical Engineers
    f. American Society for Testing and Materials

g. Concrete Reinforcing Steel Institute
h. Department of Community Affairs
i. Electronics Industries Association/Telecommunications Industry Association
j. Florida Building Code, 2023
k. Florida Fire Prevention Code, 2023
l. Institute of Electrical and Electronics Engineers
m. Illumination Engineering Society
n. Local Power Company Requirements
o. Lightning Protection Institute
p. Local Telephone Company Requirements
q. National Electrical Code, 2020
r. National Energy Conservation Policy Act
s. National Electrical Safety Code
t. National Electrical Manufacturers Association
u. NFPA 1 Fire Code, 2021
v. NFPA 101 Life Safety Code, 2021
w. Occupational Safety and Health Act
x. Safety Code for Elevators and Escalators ASME/A17.1-2019
y. Sheet Metal and Air Conditioning Contractors
z. Underwriters Laboratories, Inc.
aa. Applicable Federal, State, Local Codes, Laws and Ordinances, Florida Statutes and Referenced Codes/Standards.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION

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SECTION 26 05 10 - ELECTRICAL SYMBOLS AND ABBREVIATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

1.2 SUMMARY

A. Symbols and abbreviations are specifically applicable to all Division 26 27 28 sections in addition to those in Division 1 - General Requirements and any supplemental requirements/conditions.

1.3 SYMBOLS

A. In general, the symbols used on the drawings conform to the Standard Symbols of the Institute of Electrical and Electronic Engineers with the exception of special systems or agencies as hereinafter noted. Corps of Engineers. Special Symbols as shown in schedules or legends.

1.4 ABBREVIATIONS

A. The following abbreviations or initials are used.

A/C	Air Conditioning
AFD	Adjustable Frequency Drive
A.C.	Alternating Current ADD # Addendum #
A/E	Architect/Engineer (or Engineer when Architect not applicable)
AFF	Above Finished Floor
AFG	Above Finished Grade
AHU	Air Handler Unit
AIC	Amps Interrupting Capacity
AL	Aluminum
ALT	Alternate AMP Ampere
ANSI	American National Standards Institute AWG American Wire Gauge
@	At
B.C.	Bare Copper
BLDG	Building
BRKR	Breaker
BTU	British Thermal Unit
BTUH	BTU Per Hour
C.	Conduit
C.B.	Circuit Breaker
CBM	Certified Ballast Manufacturers
cd	Candela
CFM	Cubic Feet per Minute
CKT.	Circuit
CKT	BRKR Circuit Breaker
C/L	Center Line
Clg.	Ceiling Comp. Compressor

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SECTION 26 05 19 - BUILDING WIRE AND CABLE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the sections included under Division 1, General Requirements, are included as a part of this section as though bound herein.

1.2 SUMMARY

A. Provide all equipment, labor, material, accessories, and mounting hardware to properly install all conductors and cables rated 600 volts and less for a complete operating system for the following:

1. Building wire and cable.
2. Wiring connectors and connections.

B. All sizes shall be given in American Wire Gauge (AWG) or in thousand circular mils (MCM/KCMIL).

1.3 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

B. ANSI/Fed. Spec J-C 30B – Metal Clad Cables, Interlocking Galvanized Steel Tape Armor.

1.4 SUBMITTALS

A. Product Data: Submit catalog cut sheet showing, type and UL listing of each type of conductor, connector, and termination.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years' experience.

1.6 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.7 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet Project Conditions.

C. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

1.8 COORDINATION

A. Determine required separation between cable and other work.

B. Determine cable routing to avoid interference with other work.

PART 2 - PRODUCTS

2.1 BUILDING WIRE AND CABLE

A. Description: Single conductor insulated wire.

B. Conductor: Copper.

C. Insulation Voltage Rating: 600 volts.

D. Insulation: ANSI/NFPA 70, Type THHN/THWN and XHHW.

PART 3 - EXECUTION

3.1 GENERAL

A. Install products in accordance with manufacturer's instructions.

B. Conductors #10 AWG or #12 AWG shall be 600-volt type THWN/THHN unless noted otherwise, rated 90 degrees C dry, 75-degrees C wet.

C. Conductors #8 AWG and larger shall be type THWN-2/THHN unless noted otherwise, rated 90 degrees C wet or dry.

D. Use solid conductor for feeders and branch circuits 14 AWG and smaller (except for control circuits).

E. Use conductor not smaller than 12 AWG for power and lighting circuits.

F. Neatly train and lace wiring inside boxes, equipment, and panelboards.

G. All conductors shall be installed in raceway.

H. Conductor sizes indicated on circuit homeruns or in schedules shall be installed over the entire length of the circuit unless noted otherwise on the drawings or in these specifications.

I. Before installing raceways and pulling wire to any mechanical equipment, verify electrical characteristics with final submittal on equipment to assure proper number and AWG of conductors. (As for multiple speed motors, different motor starter arrangements, etc.).

J. Coordinate all wire sizes with lug sizes on equipment, devices, etc. Provide/install lugs as required to match wire size.

K. Where oversized conductors are called for (due to voltage drop, etc.) provide/install lugs as required to match conductors, or provide/install splice box, and splice to reduce conductor size to match lug size.

3.2 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that mechanical work is likely to damage wire has been completed.

3.3 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

3.4 WIRING METHODS

A. Use only building wire, type (THHN/THWN for #10 and #12 and THHN/THWN-2 for #8 and larger) insulation, in raceway or cable (AC or MC) unless noted otherwise.

B. Wiring in vicinity of heat producing equipment: Use only XHHW insulation, in raceway.

C. Conductors installed within fluorescent fixture channels shall be Type THHN or XHHW, rated 90 degrees C dry. Conductors for all other light fixtures shall have temperature ratings as required to meet the UL listing of the fixture; however, in no case shall the temperature rating be less than 90 degrees Centigrade. Remove incorrect insulation types in new work.

D. Pre-manufactured cable systems for power distribution are not allowed.

E. MC Type cable is not allowed.

3.5 INTERFACE WITH OTHER PRODUCTS

A. Identify wire and cable under provisions of Section Identification for Electrical Systems.

B. Identify each conductor with its circuit number or other designation indicated on Drawings.

C. Identify neutrals with their associated circuit number(s).

3.6 FIELD QUALITY CONTROL

A. Perform field inspection and testing under provisions of the General Requirements of the Contract Documents and Section Tests and Performance Verification of Electrical Systems.

B. Inspect wire for physical damage and proper connection.

C. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.

D. Verify continuity of each branch circuit conductor.

3.7 PULLING

A. No wire shall be pulled until the conduit system is complete from pull point to pull point and major equipment terminating conduits have been fixed in position.

B. Mechanical pulling devices shall not be used on conductors sized #8 and smaller. Pulling means which might damage the raceway shall not be used.

C. Use only powdered soapstone or other pulling lubricant acceptable to the A/E. Compound or lubricant shall not cause the conductor or insulation to deteriorate.

D. All conductors to be installed in a common raceway shall be pulled together. The manufacturer's recommended pulling tensions shall not be exceeded.

E. Bending radius of insulated wire or cable shall not be less than the minimum recommended by the manufacturer.

F. Where communications type conductors are installed, special requirements shall apply as outlined under that specific system detail specifications.

3.8 CONTROL AND SIGNAL CIRCUITS

A. For control and signal circuits above 50 VAC, conductors shall be #14 AWG minimum size, Type XHHW or THWN-THHN as permitted by NFPA 70, within voltage drop limits, increased to #12 AWG as necessary for proper operation.

B. For control and signal circuits 50 VAC and below, conductors, at the Contractor's option, may be #16 AWG, 300 volts rated, PVC insulated, except where specifically noted otherwise in the contract documents.

C. Conductor insulation for Fire Alarm Systems shall be accepted by Code Inspection Authority only. Wire acceptance by the A/E shall not supersede this final Acceptance for conditions of this specific project.

D. Install circuit conductors in conduit.

E. Circuit conductors to be stranded.

3.9 COLOR CODING

A. All power feeders and branch circuits No. 6 and smaller shall be wired with color-coded wire with the same color used for a system throughout the building. Power feeders above No. 6 shall either be fully color-coded or shall have black insulation and be similarly color-coded with tape or paint in all junction boxes and panels. Tape or paint shall completely cover the full length of conductor insulation within the box or panel.

B. Unless otherwise accepted or required by A/E to match existing, color-code shall be as follows: Neutrals to be white for 120/208V system, natural grey for 277/480V system; ground wire green, bare. 120/208V, Phase A - black; Phase B - red; Phase C - blue. 480/277V, Phase A brown; Phase B - orange; Phase C - yellow. All switch legs, other voltage system wiring, control and interlock wiring shall be color-coded other than those above.

3.10 TAPS/SPLICES/CONNECTORS/TERMINATIONS

A. Clean conductor surfaces before installing lugs and connectors.

B. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

C. Power and lighting conductors shall be continuous and unplaced where located within conduit. Splices shall occur within troughs, wireways, outlet boxes, or equipment enclosures where sufficient additional room is provided for all splices. No splices shall be made in in-ground pull boxes (without written acceptance of engineer).

D. Splices in lighting and power outlet boxes, wireway, and troughs shall be kept to a minimum, pull conductors through to equipment, terminal cabinets, and devices.

E. No splices shall be made in junction boxes, and outlet boxes (wire No. 8 and larger) without written acceptance of Engineer.

F. No splices shall be made in communications outlet boxes, pull boxes or wireways (i.e., fire alarm, computer, telephone, intercom, sound system, etc.) without written acceptance of Engineer. Pull cables through to equipment cabinets, terminal cabinets and devices.

G. Allow adequate conductor lengths in all junction boxes, pull boxes and terminal cabinets. All termination of conductors in which conductor is in tension will be rejected and shall be replaced with conductors of adequate length. This requirement shall include the providing by the Contractor of sleeve type vertical cable supports in vertical raceway installations provided in pull boxes at proper vertical spacings.

H. A calibrated torque wrench shall be used for all bolt tightening.

I. Interior Locations:

1. All (non-electronic systems) copper taps and splices in No. 8 or smaller shall be fastened together by means of "spring type" connectors. All taps and splices in wire larger than No. 8 shall be made with compression type connectors and taped to provide insulation equal to wire.

J. Exterior Locations:

1. Make splices, taps and terminations above grade in splice or termination cabinets. Do not splice any cable in ground or below finished grade.

2. All taps and splices shall be made with compression type connectors and covered with Raychem heavy wall cable sleeves (type CRSM-CT, WCSM or MCK) with type "S" sealant coating with sleeve kits as per manufacturer's installation instructions or be terminated/connected to terminal strips in above grade terminal boxes suitable for use.

3. Provide and install above grade termination cabinets sized to meet applicable codes and standards, where required for splicing.

END OF SECTION

SECTION 26 05 26 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the sections included under Division 1, General Requirements, are included as a part of this section as though bound herein.

1.2 SUMMARY

A. Provide all labor, materials, and equipment necessary to properly install a grounding system conductor in all new branch wiring and feeder installations, which shall be in full compliance with all applicable Codes as accepted by the Authorities having jurisdiction. The secondary distribution system shall include a grounding conductor in all raceways in addition to the return path of the metallic conduit.

B. In general, all electrical equipment (metallic conduit, motor frames, panelboards, etc.) shall be bonded together with a green insulated or bare copper system grounding conductor in accordance with specific rules of Article 250 of the NEC and State codes. Bonding conductor through the raceway system shall be continuous from main switch ground bus to panel ground bar of each panelboard, and from panel grounding bar of each panelboard to branch circuit equipment and devices.

C. All raceways shall have an insulated copper system ground conductor throughout the entire length of circuit installed with-in conduit in strict accordance with NEC. Grounding conductor shall be included in total conduit fill determining conduit sizes, even though not included, or shown on drawings. Grounding conductors that run with feeders in PVC conduit outside of building(s) shall be bare only.

D. Provide and install all grounding and bonding as required by the National Electrical Code (NEC) including but not limited to Article 250 of the NEC.

E. Section Includes

1. Grounding electrodes and conductors
2. Equipment grounding conductors
3. Bonding
4. Counterpoise system
5. Ground ring

1.3 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

1.4 SUBMITTALS

A. Refer to Division 1 requirements.

B. Submit catalog cut sheet/product data on:

1. Ground rods and couplings
2. Mechanical connectors
3. Ground wells
4. Ground bus bars and associated components
5. Ground ring conductor
6. Counterpoise conductor
7. Exothermic welding materials and molds
8. Testing equipment and procedures.

C. Product data shall prove compliance with Specifications. National Electrical Code, manufacturer's specifications, and written installation data.

1.5 PROJECT RECORD DOCUMENTS

A. Submit record documents to accurately record actual locations of grounding electrodes.

B. Submit test results of each ground rod. See Section Tests and Performance Verification of Electrical Systems.

1.6 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.1 ROD ELECTRODE

A. Material: Copper-clad steel.

B. Diameter: 5/8 inch.

C. Length: 30 feet (minimum). Increase lengths as required to meet and achieve specified resistance.

2.2 MECHANICAL CONNECTORS

A. All grounding connectors shall be in accordance with UL 467 and UL listed for use with rods, conductors, reinforcing bars, etc., as appropriate.

B. Connectors and devices used in the grounding systems shall be fabricated of copper or bronze materials, and properly applied for their intended use. Specified items of designated manufacturers indicate required criteria and equal products may be provided if approved. All connectors and devices shall be compatible with the surfaces being bonded and shall not cause galvanic corrosion by dissimilar metals. Materials in items not listed herein shall be of equal quality to the following specified items:

1. Lugs: Substantial construction, of cast copper or cast bronze, with "ground" (micro-flat) surfaces, twin clamp, two-hole tongue, equal to Burndy QQA Series or T&B equal. Lightweight and "competitive" devices shall be rejected.
2. Grounding and Bonding Bushings: Malleable iron, Thomas, and Betts (T&B), or equal.
3. Piping Clamps: Burndy GAR-TC Series with two-hole compression terminal or T&B equal.
4. Grounding Screw and Pigtail: Raco No. 983 or equal.
5. Building Structural Steel, Existing: Thompson 701 Series heavy duty bronze "C" clamp with two-bolt vise-grip cable clamp.

C. Mechanical lugs or wire terminals shall be used to bond ground wires together or to junction boxes and panel cabinets and shall be manufactured by Anderson, Buchanan, Thomas and Betts Co., or Burndy.

2.3 WIRE

A. Material: Stranded copper.

B. Size: Size to meet NFPA 70 requirements as a minimum. Increase size if called for on drawings, in these specifications, or as required for voltage drop.

C. Insulated THWN (or bare as noted elsewhere).

2.4 GROUNDING WELL COMPONENTS

A. Grass Non-Traffic Areas:

1. Well: Minimum 18 inch long sleeve with minimum 12 inch diameter.

2. Well Cover: High-density plastic, composolite, or cast iron with legend "GROUND" embossed on cover.
3. Material: Structural Plastic, composolite, or concrete.
4. Manufacturer: Carson 2200 Series or equal by Quazite.
5. Increase depth, diameter or size as required to provide proper access at installed location.
6. Paving and Low Traffic Areas:
7. Well: Minimum 12 inch long by 12 inch wide by 18 inches deep with open bottom.
8. Well Cover: Traffic rated for use with "GROUND" embossed on cover.
9. Material: Composolite.
10. Manufacturer: Quazite.
11. Increase depth, diameter or size as required to provide proper access at installed location.

2.5 GROUNDING BARS/GROUND BUS (INCLUDING 'SYSTEMS' GROUND BUS/BARS AND GROUND BUS BARS)

A. Ground bars shall be copper of the size and description as shown on the drawings. If not sized on drawings, bus bar shall be minimum 1/4" x 2" bus grade copper, spaced from wall on insulating 2 inch polyester molded insulator standoff/supports, and be 12 inches or greater minimum overall length, allowing 2 inch length per lug connected thereto. Increase overall length as required to facilitate all lugs required while maintaining 2 inch spacing. Size of bus bar used in main electrical room shall be similar except minimum of 4 inches high and 24 inches long.

B. Provide bolt-tapping lug with two hex head mounting bolts for each terminating ground conductor, sized to match conductors. Mount on bus bar at 2 inches on center spacing. Lugs to be manufactured by Burndy or T&B.

C. Standoff supports to be 2 inches polyester as manufactured by Glastic #2015-4C.

PART 3 - EXECUTION

3.1 GENERAL

A. Install products in accordance with manufacturer's instructions.

B. Install grounding electrodes conductor, bonding conductors, ground rods, etc. with all required accessories.

C. Grounding shall meet (or exceed as required to meet these specifications) all the requirements of the NEC, the NFPA, and applicable standards of IEEE.

D. Where there is a conflict between these specifications and the above applicable codes/standards, or between this section of these specifications and other sections, then the most stringent or excessive requirement shall govern. Where there is an omission of a code/standard requirement in these specifications then the code/standard requirements shall be complied with.

E. Requirement in these specifications to comply with a specific code/standard article, etc. is not to be construed as deleting of requirements of other applicable codes/standards and their articles, etc.

3.2 GROUNDING ELECTRODES

A. All connections shall be exothermic welded unless otherwise noted herein. All connections above grade and in accessible locations may be by exothermic welding or by braising or clamping with devices UL listed as suitable for use except in locations where exothermic welding is specifically specified in these specifications or called for on drawings.

B. Each rod shall be die stamped with identification of manufacturer and rod length.

C. Install rod electrodes at locations indicated and/or as called for in these specifications.

D. Ground Resistance:
   1. Main Electrical Service (to each building) and Generator Locations:
      a. Grounding resistance measured at each main service electrode system and at each generator electrode system shall not exceed 5 ohms.
   2. Other Locations:
      a. Resistance to ground of all non-current carrying metal parts shall not exceed 25 ohms measured at motors, panels, busses, cabinets, equipment racks, light poles, transformers, and other equipment.
      b. Lightning Protection system ground locations shall not exceed 25 ohms for the Franklin System measured at ground electrode.
   3. Resistance called for above shall be maximum resistance of each ground electrode prior to connection to grounding electrode conductor. Where ground electrode system being measured consists of two or more ground rod electrodes then the resistance specified above shall be the maximum resistance with two or more rods connected together but not connected to the grounding electrode conductor.

E. Install additional rod electrodes as required to achieve specified resistance to ground (specified ground resistance is for each ground rod location prior to connection to ground electrode conductor). Depending on soil condition, etc. of ground rod locations, it has been found that the ground rod lengths required to achieve the specified resistance may range from the minimum specified length to up to 80 feet or more in length.

F. Provide grounding well with cover at each rod location. Install grounding well top flush with finished grade.

G. Verify that final backfill, and compaction has been completed before driving rod electrodes.

H. Install ground rods not less than 1 foot below grade level and not less than 2 feet from structure foundation.

3.3 GROUNDING ELECTRODE CONDUCTOR

A. Conductor shall be sized to meet (or exceed as required to meet these specifications and/or drawings) the requirements of NEC 250.

3.4 EQUIPMENT GROUNDING CONDUCTOR

A. Grounding conductors shall be provided with every circuit to meet (or exceed as required to meet these specifications and/or drawings) the requirements of NEC 250.

B. At every voltage level, new portions of the electrical power distribution system shall be grounded with a dedicated copper conductor, which extends from termination back to power source in supply panelboard.

C. Provide separate, insulated (bare if feeder in PVC conduit outside of building(s)) conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

D. Except as otherwise indicated, each feeder raceway on the load side of the service entrance shall contain a ground conductor sized as indicated and where not shown shall be sized to meet (or exceed as required to meet these specifications and/or drawings) the requirements of NEC 250. Conductor shall be connected to the equipment grounding bus in switchboards and panelboards, to the Grounding Bus in all motor control centers, and as specified, to lighting fixtures, motors and other types of equipment and outlets. The ground shall be in addition to the metallic raceway and shall be properly connected thereto, using a lug device located within each item enclosure at the point of electric power connections to permit convenient inspection.

E. Provide green insulated ground wire for all grounding type receptacles and for equipment of all voltages. In addition to grounding strap connection to metallic outlet boxes, a supplemental

grounding wire and screw equal to Raco No. 983 shall be provided to connect receptacle ground terminal to the box.

F. All plug strips and metallic surface raceway shall contain a green insulation ground conductor from supply panel ground bus connected to grounding screw on each receptacle in strip and to strip channel. Conductor shall be continuous.

G. Where integral grounding conductor is specified elsewhere in bus duct construction, provide equivalent capacity conductor from supply switchboard or panelboard grounding bus to the bus duct grounding conductor. Bond integral conductor to bus duct enclosure at each tap and each termination.

H. All motors, all heating coil assemblies, and all building equipment requiring flexible connections shall have a green grounding conductor properly connected to the frames and extending continuously inside conduit with circuit conductors to the supply source bus with accepted connectors regardless of conduit size or type. This shall include Food Service equipment, laundry equipment, and all other "Equipment by Owner" to which an electric conduit is provided under this Division.

3.5 MAIN ELECTRICAL SERVICE

A. Complete installation shall meet and exceed the requirements of the NEC 250.

B. Artificial electrodes shall be provided for the main service in sufficient number and configuration to secure resistance specified.

C. Provide and bond to all of the following:

1. Ground rods.
2. Metal water pipe (interior and exterior to building).
3. Building metal frame, structural steel and/or reinforced structural concrete.
4. All piping entering or leaving all buildings (including chilled water piping).
5. Encased electrodes.
6. Ground ring.
7. Site distribution counterpoise ground system.
8. Lightning protection system.

D. A main ground, bare copper conductor, sized per applicable table in NEC 250, but in no case less than #2/0, shall be run in conduit from the main switchgear of each building to the building steel in respective building. This ground conductor shall also be run individually from the main switchgear and be bonded to the main water service ahead of any union in pipe and must be metal pipe of length and location as acceptable by authorities having jurisdiction. Provide properly sized bonding shunt around water meter and/or dielectric unions in the water pipe. Also required is the same size ground wire to ground rod electrode as called for below:

1. Three 30 feet. ground rods in a delta configuration at no less than 30 feet. spacing driven to a minimum depth of 30 feet. plus 1 below grade. If three 30 ee rods in a delta configuration does not provide specified resistance change rod lengths from minimum specified to 40 or more feet as required to provide specified resistance. Adjust rod spacing as required to provide spacing equal to or greater than the driven depth of the deepest ground rod.
2. Bond ground rod electrodes together with a bare copper ground conductor that matches size required by applicable table in NEC 250, but in no case less than #2/0.
3. Provide additional rod electrodes as required to achieve specified ground resistance.

E. Ground/bond neutral per NEC 250.

F. A main ground, bare copper conductor, sized per applicable table in NEC 250, but in no case less than #2/0, shall be run in conduit from the main switchgear of each building to a concrete encased electrode per NEC 250.52(A)(3).

G. Bond grounding electrodes to site counterpoise grounding system and lightning protection system where provided.

H. Provide and install ground bus bar on wall near main service disconnect/switchboard. Connect to ground bar in disconnect/switchboard bonded to switchboard/disconnect enclosure/neutral with copper grounding conductor sized per applicable table in NEC 250.

3.6 TRANSFORMER GROUNDING

A. Ground all transformers and enclosures of 120/208V and 277/480V "separately derived systems" as specified herein.

1. Ground per NEC 250 and these specifications.
2. Bond neutral to transformer frame/enclosure and the equipment grounding conductors of the derived system with copper ground conductor sized per applicable table in NEC 250.
3. Connect transformer neutral/ground to grounding electrode per NEC 250 with grounding electrode conductor sized per applicable table in NEC 250.
4. In addition to connection to grounding electrode conductor called for above (i.e., per NEC 250) provide, install, and connect supplemental grounding electrode as follows:
    a. Where grounding required per NEC 250 is to building steel/structure, supplement this grounding with connection to nearest available effectively grounded metal water pipe.
    b. Where grounding connection required per NEC 250 is to grounded metal water pipe, supplement this grounding with connection to building steel/structure in addition to any other available electrodes specified in NEC 250.
    c. Where supplemental grounding electrodes required above is a ground rod electrode, provide, install, and connect two or more 30 feet ground rod electrodes at no less than 30 feet spacing, driven vertical to a minimum depth of 30 feet plus 1 below grade.
5. Where neither building steel nor water pipe grounding electrodes are available (i.e., exterior locations with no available water pipe electrode) provide two ground connections: each to two or more 30 feet ground rod electrodes at no less than 30 feet spacing, driven vertical to a minimum depth of 30 feet plus 1 below grade.
6. Where transformer is mounted exterior to building one of the two ground electrodes required shall be ground rod electrode as called for in 5 above. This ground rod electrode shall also be connected to counterpoise system (wherever counterpoise system is available).
7. Ground to water system service pipe as required by NEC 250.

B. Provide additional ground electrodes as required to achieve specified ground resistance.

C. Where two or more ground electrodes are used at any one required ground location, they shall be bonded together with a copper ground conductor, sized to meet applicable table in NEC 250, but in no case less than #2/0.

D. Complete installation shall exceed the minimum requirements of NEC 250.

E. Equipment ground conductors shall be provided in addition to above grounding. See 'EQUIPMENT GROUNDING CONDUCTOR'.

F. Provide and install ground bus bar on wall near transformer (or in associated electrical room for exterior mounted transformers). Connect to ground lug in transformer bonded to transformer enclosure/neutral with copper ground conductor sized per applicable table in NEC 250.

G. Multiple separately derived systems may be grounded as allowed in NEC 250-30 (A) (4).

3.7 GENERATOR GROUNDING

A. Separately derived systems (i.e., systems where generator neutral is not solidly interconnected to service supplied system neutral such as 4-pole switched neutral transfer switch systems).
   1. Ground per NEC 250 and these specifications.
   2. Bond neutral to transformer frame/enclosure and the equipment grounding conductors of the derived system with copper ground conductor sized per applicable table in NEC 250.
   3. Connect generator neutral/ground to grounding electrodes per NEC 250 with grounding electrode conductor sized per applicable table in NEC 250.
   4. In addition to connection to grounding electrode conductor called for above (i.e., per NEC 250) provide, install, and connect supplemental grounding electrode as follows:
      a. Where grounding required per NEC 250 is to building steel/structure, supplement this grounding with connection to nearest available effectively grounded metal water pipe.
      b. Where grounding connection required per NEC 250 is to grounded metal water pipe, supplement this grounding with connection with connection to other electrodes specified in NEC 250.
      c. Where supplemental grounding electrodes required above is a ground rod electrode, provide, install, and connect two or more 30' ground rod electrodes at no less than 30' spacing, driven vertical to a minimum depth of 30' plus 1' below grade.
   5. Where neither building steel nor water pipe grounding electrodes are available (i.e., exterior locations with no available water pipe electrode) provide two ground connections: each to two or more 30' ground rod electrodes at no less than 30' spacing, driven vertical to a minimum depth of 30' plus 1' below grade.
   6. Where generator is mounted exterior to building one of the two ground electrodes required shall be ground rod electrode as called for in paragraph 5. above. This ground rod electrode shall also be connected to counterpoise system.

B. Non separately derived systems (i.e., systems where generator neutral is solidly interconnected to service supplied system neutral such as 3-pole non-switched neutral transfer switch systems).
   1. Ground per NEC 250 and these specifications.
   2. Do not bond neutral to transformer frame/enclosure or the equipment grounding conductors of the derived system.
   3. Connect generator frame/enclosures ground to grounding electrode per NEC 250 with grounding electrode conductor sized per applicable table in NEC 250.
   4. In addition to connection to grounding electrode conductor called for above (i.e., per NEC 250) provide, install, and connect supplemental grounding electrode as follows:
      a. Where grounding required per NEC 250 is to building steel/structure, supplement this grounding with connection to nearest available effectively grounded metal water pipe.
      b. Where grounding connection required per NEC 250 is to grounded metal water pipe, supplement this grounding with connection to other electrodes specified in NEC 250.
      c. Where supplemental grounding electrodes required above is a ground rod electrode, provide, install, and connect two or more 30' ground rod electrodes at no less than 30' spacing, driven vertical to a minimum depth of 30' plus 1' below grade.
   5. Where neither building steel nor water pipe grounding electrodes are available (i.e., exterior locations with no available water pipe electrode) provide two ground connections: each to two or more 30' ground rod electrodes at no less than 30' spacing, driven vertical to a minimum depth of 30' plus 1' below grade.
   6. Where generator is mounted exterior to building one of the two ground electrodes required shall be ground rod electrode as called for in paragraph 5. above. This ground rod electrode shall also be connected to counterpoise system.

C. Provide additional ground electrodes as required to achieve specified ground resistance.

D. Where two or more ground electrodes are used at any one required ground location, they shall be bonded together with a copper ground conductor, sized to meet applicable table in NEC 250, but in no case less than #2/0.

E. Complete installation shall exceed the minimum requirements of NEC 250.

F. Equipment ground conductors shall be provided in addition to above grounding. See “Equipment Grounding Conductors.”

3.8 LIGHTNING PROTECTION SYSTEMS

A. Ground per applicable section on lightning protection system, NFPA 780, and as specified herein. The most stringent requirements shall govern.

B. Bond lightning protection system grounds to electrical service system ground, all piping entering or leaving all buildings, and counterpoise system ground where provided.

C. See Section Lightning Protection System.

3.9 EXTERIOR GRADE (OR FREE-STANDING ABOVE GROUND) MOUNTED EQUIPMENT

A. General:

1. All equipment (including chillers, pumps, disconnects, starters, control panels, panels, etc.) mounted exterior to building shall have their enclosures grounded directly to a grounding electrode at the equipment location in addition to the building equipment ground connection.
2. Bond each equipment enclosure, metal rack support, mounting channels, etc. to ground electrode system at each rack with an insulated copper ground conductor sized to match the grounding electrode conductor required by applicable table in NEC 250 based on equipment feeder size, but in no case shall conductor be smaller than #6 copper or larger than #2 copper. This connection is in addition to grounding electrode connections required for services.

B. Main electrical service rack mounted equipment.

1. Ground per "MAIN ELECTRICAL SERVICE".
2. Bond all metal parts as noted above.

C. Electrical sub service rack mounted equipment.

1. Ground per "MAIN ELECTRICAL SERVICE", except do not bond neutral to ground.
2. Bond all metal parts as noted above.

D. Electrical equipment connection rack mounted equipment.

1. Bond all metal parts as noted above.

E. Grounding electrodes (ground electrodes system) shall be:

1. Located at each rack location.
2. For service equipment: Ground electrode required per "MAIN ELECTRICAL SERVICE".
3. For equipment connection equipment: Two or more 30 ft. ground rods at no less than 30 ft. spacing, driven vertical to a minimum depth of 1 ft below grade. Bond the two or more ground rods together with a size to meet applicable table in NEC 250, but no less than a #2 copper ground conductor. Provide additional rod electrodes as required to achieve specified ground resistance.

F. Complete installation shall exceed the minimum requirements of NEC 250 and, when applicable, NFPA 780.

3.10 ROOF MOUNTED EQUIPMENT

A. Bond all roof mounted electrical equipment to lightning protection system (when provided) per NFPA 780.

B. Where lightning protection system is not provided, ground/bond all roof mounted electrical equipment to building steel and to two (2) or more 30 ft. ground rods at no less than 30 ft. spacing driven vertically to a minimum depth of 30 ft. plus 1 below grade.
   1. Bond the two or more ground rods together with a Class I or Class II as required per NFPA 780 lightning protection main copper conductor.
   2. Provide additional rod electrodes as required to achieve specified ground resistance.
   3. Complete installation shall exceed the minimum requirements of NFPA 780.

3.11 LIGHTING FIXTURES

A. All new fixtures in building interior, and exterior fixtures shall be provided with green grounding conductor, solidly connected to unit. Individual fixture grounds shall be with lug to fixture body, generally located at point of electrical connection to the fixture unit.

B. All suspended fixtures and those supplied through flexible metallic conduit shall have green ground conductor from outlet box to fixture. Cord connected fixtures shall contain a separate green ground conductor.

C. Pole Light Fixtures:
   1. Metal Pole Light Fixtures:
      a. Freestanding pole mounted lighting fixtures shall each have a Class I or Class II lightning protection main copper down conductor connected to grounding electrodes at base of pole.
      b. Conductor shall be bonded to metal pole via UL Listed ground clamp suitable for use. Locate ground lug opposite to handhole (or adjacent if visible through handhole).
   2. Concrete or Non-Metallic Pole:
      a. Freestanding pole mounted lighting fixtures shall each have a Class I or Class II lightning protection main copper down conductor connected to grounding electrodes at base of pole.
      b. Conductor shall be extended from grounding electrode to top of pole and terminate at the top of pole in a Class I or Class II copper lightning protection air terminal.
      c. Each metal part of light fixture assembly, bracket, ballast cabinet, disconnect, transformer, etc. that is mounted to pole shall be bonded to down conductor.
   3. Fixtures located on elevated roadway ramps shall be specially provided with a connection to lightning counterpoise grounding system, properly installed.
   4. Grounding electrode(s) at each pole shall be connected (bonded) to site distribution counterpoise system.
   5. Grounding Electrodes:
      a. Two or more 10 feet. ground rods at no less than 10 feet. spacing shall be driven vertically to a minimum depth of 10 feet. plus 1 below grade.
      b. Bond the two or more ground rod electrodes together with a Class I or Class II lightning protection main copper conductor.
      c. Provide additional rod electrodes as required to achieve specified ground resistance.
      d. The 2 or more grounding rod electrodes shall be installed at each light pole.
   6. Installation shall exceed minimum requirements of NFPA 780.

3.12 PULLBOX, MANHOLE, HANDHOLE GROUNDING.

A. One 30 feet. ground rod electrode shall be driven vertically to a minimum depth of 30 feet. plus 1 feet. below grade in each manhole, handhole or pull box (in ground).

B. The complete installation shall exceed the minimum requirements of the NEC.

C. Provide additional ground rod electrodes as required to provide resistance called for herein.

D. Where more than one ground rod electrode is required bond the two or more ground rod electrodes together with a copper ground conductor.

E. Bond to counterpoise system (whenever counterpoise system is provided.)

F. Bond grounding electrode to all exposed metal parts of manhole, handhole, and pull box (including metal cover) with #6 copper ground conductor. Connect to ground rod electrode with exothermic weld. Connect to metal cover with exothermic weld. Connect to other metal parts with exothermic weld or UL accepted grounding clamp. Provide 3 feet. or more slack ground cable on cover connection as required to facilitate removal of cover.

3.13 HAZARDOUS LOCATIONS

A. Ground in hazardous locations shall be done in accordance with applicable portions of NEC 500, 501, 502, 503, 511 and 514.

3.14 GROUND RING

A. Provide complete underground building perimeter ground ring system, completely encircling each building.

B. Conductor shall be minimum of Class II lightning protection copper conductor (bare).

C. Install not less than 2-1/2 feet depth into earth.

D. Install ground rods (minimum 30 feet long) at 150-foot intervals along ground ring conductor.

E. Bond ground ring to building steel every 150 feet of building perimeter, bond to any and all electrical and piping systems that cross the ground ring system, bond to lightning protection down conductors and to any lightning or other earth grounding electrodes that may be present on the premises.

F. Bond to building service and counterpoise ground systems.

3.15 MISCELLANEOUS GROUNDING CONNECTIONS

A. Provide bonding to meet regulatory requirements.

B. Required connections to building steel shall be with UL accepted non-reversible crimp type ground lugs exothermically welded to bus bar that is either exothermically welded to steel or bolted to steel in locations where weld will affect the structural properties of the steel. Required connections to existing building structural steel purlins/I beams shall be with heavy duty bronze "C" clamp with two bolt vise-grip cable clamp.

C. Grounding conductors shall: be so installed as to permit shortest and most direct path from equipment to ground; be installed in conduit; be bonded to conduit at both ends when conduit is metal; have connections accessible for inspection; and made with accepted solderless connectors brazed (or bolted) to the equipment or to be grounded; in NO case be a current carrying conductor; have a green jacket unless it is bare copper; be run in conduit with power and branch circuit conductors. The main grounding electrode conductor shall be exothermically welded to ground rods, water pipe, and building steel.

D. All surfaces to which grounding connections are made shall be thoroughly cleaned to maximum conductive condition immediately before connections are made thereto. Metal rustproofing shall be removed at grounding contact surfaces, for 0 ohms by digital Vm. Exposed bare metal at the termination point shall be painted.

E. All ground connections that are buried or in otherwise inaccessible locations, shall be welded exothermically. The weld shall provide a connection which shall not corrode or loosen, and which shall be equal or larger in size than the conductors joined together. The connection shall have the same current carrying capacity as the largest conductor.

F. Install ground bushings on all metal conduits entering enclosures where the continuity of grounding is broken between the conduit and enclosure (i.e., metal conduit stub-up into a motor

control center enclosure or at ground bus bar). Provide an appropriately sized bond jumper from the ground bushing to the respective equipment ground bus or ground bus bar.

G. Install ground bushings on all metal conduits where the continuity of grounding is broken between the conduit and the electrical distribution system (i.e., metal conduit stub-up from wall outlet box to ceiling space. Provide an appropriately sized bond jumper from the ground bushing to the respective equipment ground bus or ground bus bar.

H. Each feeder metallic conduit shall be bonded at all discontinuities, including at switchboards and all sub distribution and branch circuit panels with conductors in accordance with applicable table in NEC 250 for parallel return with respective interior grounding conductor.

I. Grounding provisions shall include double locknuts on all heavy wall conduits.

J. Bond all metal parts of pole light fixtures to ground rod at base.

K. Install grounding bus in all existing panelboards of remodeled areas, for connection of new grounding conductors, connected to an accepted ground point.

L. Bond together reinforcing steel and metal accessories in pool and fountain structures and bond to electrical system per NEC.

M. Where reinforced concrete is utilized for building grounding system, proper reinforced bonding shall be provided to secure low resistance to earth with "thermite" type devices, and #10AWG wire ties shall be provided to not less than 10 full length rebars which contact the connected rebar (by Division 26 contractor). Provide size and length of rod to meet NEC requirements.

3.16 GROUNDING BAR/GROUND BUS (INCLUDING 'SYSTEMS' GROUND BUS/BAR ON GROUND BUS/BAR) INSTALLATION

A. Where indicated on the drawings provide and install grounding bar/ground bus (bus bar). These bus installations are intended to provide a low-impedance "earthing" path for surge voltages, which are electrically "clamped" and shunted to earth by variable-impedance surge protective devices. Metal sheaths of underground cables are also to be grounded thereto at points of building entrance.

B. Mount bolt tapping lugs with hex-head bolts to bus bar at 2 inch oc spacing, one for each ground conductor.

C. Mount bus bar to wall using 2 inch polyester molded insulator stand-off.

D. Extend a #2/0 (minimum size) or larger THWN insulated copper ground conductor (if larger size is called for on drawings or required by NEC for service ground, etc.) in PVC conduit to accepted service ground installation or ground bus/bar in main service equipment enclosure.

E. Extend #6 insulated copper ground wire from respective bus/bar to each 'local' ground bus/bar in each cabinet for Division 28 systems.

F. 'SYSTEMS' grounding bus/bar must be connected with #2/0 insulated copper conductor to grounding electrodes system as defined in NEC "Article 800.100(B)".

3.17 COUNTERPOISE SYSTEM

A. Install counterpoise and ground over all sections of underground duct banks, conduits, or cables outside (exterior) to building.

B. No. 2 bare stranded copper counterpoise shall be run 6 inches above all underground duct banks, conduits, and cables outside (exterior) to building.

C. Provide one counterpoise conductor for duct banks (or conduit groupings) 12 inches wide or less. Provide two counterpoise conductors above outside edge of duct bank (or conduit groupings) over 12 inches wide.

D. Counterpoise shall run to building and be grounded at each building to the main building electrical service ground rod electrode (exterior to building). Counterpoise shall be bonded to ground rod at all light poles, pull boxes, manholes, handholes and at each building. Provide and install appropriate ground rod every 150 feet. length of counterpoise conductor (see

"GROUNDING ELECTRODES"). Counterpoise conductor shall not be run into interior of building. Route counterpoise underground around exterior perimeter of building to main service ground rod installation.

3.18 COMMUNICATIONS SYSTEMS

A. Provide and install all grounding as required by NEC Article 800 and where available on project: Articles 810 (Radio and Television Equipment); 820 (Community Antenna Television and Radio Distribution Systems); and 830 (Network-Powered Broadband Communications Systems.

B. Provide and install grounding electrode at point of entry of communication cables and bond to service entrance grounding electrodes per NEC 800. Install ground bus bar at point of entry of communications cable and connect electrode to ground bus. Connect communications cable metal sheath and surge protection devices to ground bar.

3.19 TESTING AND REPORTS

A. Raceway Continuity: Metallic raceway system as a component of the facilities ground system shall be tested for electrical continuity. Resistance to ground throughout the system shall not exceed specified limits.

B. Ground resistance measurements shall be made on each system utilized in the project. The ground resistance measurements shall include building structural steel, driven grounding system, water pipe grounding system and other accepted systems as may be applicable. Ground resistance measurements shall be made in normally dry weather, not less than 24 hours after rainfall, and with the ground under test isolated from other grounds and equipment. Resistances measured shall not exceed specified limits.

C. Upon completion of testing, the testing conditions and results shall be certified by the Contractor and submitted to the Architect/Engineer as called for in Section Tests and Performance Verification of Electrical Systems.

3.20 INTERFACE WITH OTHER PRODUCTS

A. Interface with site grounding system.

B. Interface with lightning protection system installed under Section Lightning Protection System.

C. Interface with communications system installed under Division 27 sections.

3.21 FIELD QUALITY CONTROL

A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

B. Use suitable test instruments to measure resistance to ground of system. Perform testing in accordance with test instrument manufacturer's recommendations using the fall-of-potential method.

END OF SECTION

SECTION 26 05 29 - HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 1, General Requirements, are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Furnish and install all supports, hangers and inserts required to mount fixtures, conduit, cables, pull boxes and other equipment furnished under this Division.

B. Section Includes:

1. Conduit and equipment support.
2. Anchors and fasteners.

1.3 REFERENCES

A. NECA - National Electrical Contractors Association.

B. ANSI/NFPA 70 - National Electrical Code.

1.4 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.1 PRODUCT REQUIREMENTS

A. Materials and Finishes: Provide corrosion resistance.

B. Exterior locations: Provide stainless steel hangers, anchors, etc. Strut may be PVC Coated or Stainless Steel.

C. Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Provide anchors, fasteners, and supports in accordance with NECA "Standard of Installation".

C. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.

D. Do not use spring steel clips and clamps.

E. Obtain permission from Architect/Engineer before using powder-actuated anchors.

F. Obtain permission from Architect/Engineer before drilling or cutting structural members.

G. Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

H. Install surface-mounted cabinets and panelboards with minimum of four anchors.

I. In wet and damp locations use steel channel supports to stand cabinets and panelboards one inch (25 mm) off wall.

J. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

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K. All items shall be supported from the structural portion of the building.

L. This Contractor shall lay out and install his work in advance of the laying of floors or walls, and shall furnish and install all sleeves that may be required for openings through floors, walls, etc. Where plans call for conduit to be run exposed, this Contractor shall furnish and install all inserts and clamps for the supporting of conduit. If this Contractor does not properly install all sleeves and inserts required, he will be required to do the necessary cutting and patching, later at his own expense, to the satisfaction of the Architect.

M. All conduits shall be securely fastened in place per NEC, and hangers, supports or fastenings shall be provided at each elbow and at the end of each straight run terminating at a box or cabinet. The use of perforated iron for supporting conduits will not be permitted. The required strength of the supporting equipment and size and type of anchors shall be based on the combined weight of conduit, hanger, and cables. Horizontal and vertical conduit runs may be supported by one-hole malleable straps, clamp-backs, or other accepted devices with suitable bolts, expansion shields (where needed) or beam-clamps for mounting to building structure or special brackets.

N. Where two or more conduits are run parallel or in a similar direction, they shall be grouped together and supported by means of Kindorf type trapeze hanger system (racking) consisting of concrete inserts, threaded solid rods, washers, nuts, and galvanized "L" angle iron, or Unistrut cross members. These conduits shall be individually fastened to the cross member of every other trapeze hanger with galvanized cast one-hole straps, clamp backs, bolted with proper size cadmium machine bolts, washers, and nuts. If adjustable trapeze hangers are used to support groups of parallel conduits, U-bolt type clamps shall be used at the end of a conduit run and at each elbow. J-bolts, or accepted clamps, shall be installed on each third intermediate trapeze hanger to fasten each conduit.

O. Hanger assemblies shall be protected after fabrication by galvanizing. Hangers for PVC coated conduit shall be PVC coated galvanized conduit or stainless steel.

P. On concrete or brick construction, insert anchors shall be installed with round head machine screws. In wood construction, round head screws shall be used. An electric or hand drill shall be used for drilling holes for all inserts in brick, concrete or similar construction. In brick, inserts shall be near center of brick, not near edge or in joint. Where steel members occur, same shall be drilled and tapped, and round head machine screws shall be used. All screws, bolts, washers, etc., used for supporting conduit or outlets shall be fabricated from rust-resisting metal, or accepted substitution. Fasteners similar to "TAP-CON" self-tapping power-driven type are acceptable. Plastic anchors are not acceptable.

Q. Conduit supporting devices such as spring type conduit clips manufactured by Caddy Corporation may not be used.

R. Threaded rod hangers shall be galvanized continuous thread type, minimum 3/8" diameter.

S. Concrete/insert anchors, threaded rods, or similar fasteners installed on side or bottom of pre-stressed beams are not acceptable.

END OF SECTION

SECTION 26 05 33 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Raceways, boxes, enclosures, handholes, sleeves, and accessories required for fully functional electrical and communication systems pathways.

1.2 RELATED SECTIONS

A. Section 01 25 13, “Product Substitution Procedures”
B. Section 01 31 00, “Project Coordination”
C. Section 01 33 00, “Submittal Procedures”
D. Section 01 35 53, “Procedures”
E. Section 01 42 00, “References”
F. Section 01 45 00, “Quality Control”
G. Section 01 66 00, “Product Storage and Handling Requirements”
H. Section 01 78 00, “Closeout Submittals”
I. Section 07 84 00, “Fire Stopping”
J. Section 07 92 00, “Joint Sealants”
K. Section 26 05 00, “Common Work Results for Electrical”
L. Section 26 05 29, “Hangers and Supports for Electrical Systems”
M. Section 26 05 43, “Underground Ducts and Raceways for Electrical Systems”
N. Section 26 05 53, “Identification for Electrical Systems”
O. Section 26 20 00, “Low Voltage Electrical Transmission”
P. Section 28 05 13, “Conductors and Cables for Electronic Safety and Security”.

1.3 REFERENCES

A. See Section 01 42 00 - for additional reference standards, definitions, abbreviations, and acronyms.
B. American National Standards Institute (ANSI):
    1. ANSI C80.1-2005: Electrical Rigid Steel Conduit.
    2. ANSI C80.3-2005: Electrical Metallic Tubing (EMT).
C. National Fire Protection Association (NFPA): NFPA 70 - National Electrical Code, 2023 Edition.
D. Underwriters Laboratories (UL):
    1. UL 5-2011: Standard for Surface Mounted Raceways and Fittings.
    2. UL 5A-2015: Nonmetallic Surface Raceways and Fittings.
    3. UL 6-2007: Electrical Rigid Metal Conduit.
    4. UL 651-11: Standard for Schedule 40, 80, Type E, B and A rigid PVC Conduit and Fittings.
    5. UL 797-2007: Electrical Metallic Tubing - Steel.
E. National Electrical Contractors Association (NECA):
    1. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2010.
    2. NEC 101-2006: Standard for Installing Steel Conduits (Rigid, IMC, EMT).
F. National Electrical Manufacturers Association (NEMA):

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SECTION 26 05 34 - OUTLET BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the sections included under Division 1, General Requirements, are included as a part of this section as though bound herein.

1.2 SUMMARY

A. Provide and install all outlet boxes (flush or surface) complete with all accessories as required to facilitate installation of electrical system and as required by the NEC.

B. Section includes Wall and ceiling outlet boxes (and/or small junction/pullboxes).

1.3 REFERENCES

A. ANSI/NEMA FB 1 - Fittings and Supports for Conduit and Cable Assemblies.

B. ANSI/NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

C. ANSI/NFPA 70 - National Electrical Code.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

1.4 SUBMITTALS

A. Submit catalog cut sheet/product data on:

1. Surface cast boxes.

B. For pullboxes and junction boxes not covered in Section Pull and Junction Boxes for Electrical Systems, submit product data showing dimensions, covers, and construction.

1.5 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.6 PROJECT CONDITIONS

A. Verify field measurements are as shown on Drawings.

B. Verify locations of outlets in offices and work areas prior to rough-in.

C. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Install at location required for box to serve intended purpose.

PART 2 - PRODUCTS

2.1 GENERAL

A. All boxes and fittings shall be labeled by Underwriters Laboratories.

B. Provide box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, outlet boxes, and corrosion-resistant knockout closures compatible with outlet boxes being used and meeting requirements of individual wiring situations.

C. All boxes shall be of the size and shape required by NFPA 70 for their respective locations.

D. Boxes shall be of such form and dimensions as to be adapted to the specific use and location, type of device or fixtures to be used, and number and size of conductors and arrangement, size and number of conduits connecting thereto.

E. Handy boxes shall not be used.

F. Where a box is used as the sole support for a ceiling paddle fan, the box must be listed for this purpose and the weight of the fan.

G. 4” x 4” boxes and 4-11/16” x 4-11/16” boxes used as junction boxes shall be one piece.

2.2 SHEET METAL OUTLET BOXES: ANSI/NEMA OS 1, GALVANIZED STEEL

A. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2 inch male fixture studs where required.

B. Concrete Ceiling Boxes: Concrete type.

C. Interior flush outlet boxes shall be galvanized steel constructed with stamped knockouts in back and sides, and threaded holes with screws for securing box cover plates or wiring devices. T & B, Steel City, Raco or accepted substitution.

D. Ceiling outlet boxes shall be 4 inch octagonal or 4” sq. X 1-1/2” deep or larger as required for number and size of conductors and arrangement, size and number of conduits terminating at them.

E. Switch, wall receptacle, telephone and other recessed wall outlet boxes in drywall shall be 4” sq. X 1-1/2” deep. For recessing exposed masonry, provide one piece 4” sq. X 1-1/2” deep wall boxes with appropriate 4 inch square cut tile wall covers Steel City series #52-C-49/52-C- 52 or accepted substitution. For recessing in furred-out block walls, provide 4 inch square box with required extension for block depth and required extension for drywall depth.

2.3 CAST BOXES: NEMA FB 1

A. Interior surface outlet boxes and conduit bodies installed from 0 inch AFF to 90 inch AFF (including fire alarm device backbox) shall be the heavy cast aluminum or iron with external threaded hubs for power devices and threaded parts for low voltage devices - Appleton, Crouse-Hinds or accepted substitution. Trim rings shall also be of one-piece construction.

B. Weatherproof outlet boxes shall be constructed of corrosion-resistant cast metal suited to each application and having threaded conduit hubs, cast metal faceplate with spring-hinged waterproof cap suitable configured, gasket, and corrosion-proof fasteners.

C. Boxes to be Type FD unless otherwise noted on drawings.

D. Freestanding cast boxes are to be type FSY (with flange). Other cast zinc boxes are not acceptable.

PART 3 - EXECUTION

3.1 GENERAL

A. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.

B. Install electrical boxes to maintain headroom and to present neat mechanical appearance.

C. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

D. Install boxes to preserve fire resistance rating of partitions and other elements.

E. Align adjacent wall-mounted outlet boxes for switches, thermostats, and similar devices with each other.

F. Use flush mounting outlet boxes in finished areas.

G. Do not install flush mounting boxes back-to-back in walls; provide minimum 6 inch separation. Provide minimum 24 inches separation in acoustic rated walls.

H. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

I. Use stamped steel bridges to fasten flush mounting outlet box between studs.

J. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

K. Support all outlet boxes from structure with minimum of one 3/8 inch all-thread rod hangers. Boxes larger than 25 square inches shall be supported with two all-thread rod hangers, minimum.

L. Do not fasten boxes to ceiling support wires.

M. Support boxes independently of conduit.

N. Use gang box where more than one device is mounted together. Do not use sectional box.

O. Use gang box with plaster ring for single device outlets.

P. Use cast outlet box in exterior locations and wet locations.

Q. Comply with applicable portions of the National Electrical Contractor's Association's (NECA) "Standard of Installation".

R. Install outlets in the locations shown on the drawings; however, the Owner shall have the right to make, prior to rough-in, slight changes in locations to reflect room furniture layouts.

S. The Contractor shall coordinate his work with that of the General Contractor so that each electrical box is the type suitable for the wall or ceiling construction provided and suitable fireproofing is inbuilt into fire rated walls.

T. The Contractor shall relocate electrical boxes as required so that electrical devices, once installed, will be symmetrically located with respect to the room layout.

U. All boxes shall be installed in a flush rigid manner with box lines at perpendicular and parallel angles to finished surfaces. Boxes shall be supported by appropriate hardware selected for the type of surface from which the box shall be supported. For example, provide metal screws for metal, wood screws for wood, and expansion devices for masonry or concrete.

V. For locations exposed to weather or moisture (interior or exterior), provide weatherproof boxes and accessories.

W. As a minimum, provide pull boxes in all raceways over 150 feet long. The pull box shall be located near the midpoint of the raceway length.

X. Provide knockout closures to cap unused knockout holes where blanks have been removed and plugs for unused threaded hubs.

Y. Provide conduit locknuts and bushings of the type and size to suit each respective use and installation.

Z. Boxes and conduit bodies shall be located so that all electrical wiring is accessible.

AA. Avoid using round boxes where conduit must enter box through side of box, which would result in a difficult and insecure connection with a locknut or bushing on the rounded surface.

BB. All flush outlets shall be mounted so that covers and plates will finish flush with finished surfaces without the use of shims, mats or other devices not submitted or accepted for the purpose. Add- a-Depth rings or switch box extension rings (Steel City #SBEX) are not acceptable. Plates shall not support wiring devices. Gang switches with a common plate where two or more are indicated in the same location. Wall-mounted devices of different systems (switches, thermostats, etc.) shall be coordinated for symmetry when located near each other on the same wall. Outlets on each side of walls shall have separate boxes. Through-wall type boxes shall not be permitted. Back-to-back mounting shall not be permitted. Trim rings shall be extended to within 1/8" of finish wall surface.

CC. Outlet boxes mounted in metal stud walls, are to be supported to studs with two screws inside of outlet box to a horizontal stud brace between vertical studs or one side of outlet box supported with opposite side mounted to section of stud or device to prevent movement of outlet box after wall finished.

DD. All outlet boxes that do not receive devices in this contract are to have blank plates installed matching wiring device plates.

EE. Mount Height.

1. Height of wall outlets to bottom above finished floors shall be as follows, unless specifically noted otherwise, or unless otherwise required by applicable codes including ADA. Verify with the Architectural plans and shop drawings for installing.

Switches	4'-0" AFF to top
Receptacles	1'-4" AFF to bottom
Lighting Panels	6'-6" AFF to centerline of highest breaker/fuse
Phone outlets	1'-4" AFF to bottom Intercom Call-in
button/handsets	4’-0” AFF to top
Fire Alarm Pull Stations	4'-0" AFF to top
Fire Alarm Strobe Lights	80" AFF to bottom
Thermostats	4'-0" AFF to top
Space Sensors	4'-0" AFF to top

2. Bottoms of outlets above counter tops or base cabinets shall be minimum 2 inches above countertop or backsplash, whichever is highest. Outlets may be raised so that bottom rests on top of concrete block course, but all outlets above counters in same area shall be at same height. It is the responsibility of this Division to secure cabinet drawings and coordinate outlet locations in relation to all cabinets as shown on Architectural plans, prior to rough-in, regardless of height shown on Division 26 Drawings.
3. Height of wall-mounted fixtures shall be as shown on the drawings or as required by Architectural plans and conditions. Fixture outlet boxes shall be equipped with fixture studs when supporting fixtures.

FF. Special Purpose Outlets.

1. Locate special purpose outlets as indicated on the drawings for the equipment served. Location and type of outlets shall be coordinated with appropriate trades involved. The securing of complete information for proper electrical roughing-in shall be included as work required under this section of specifications. Provide plug for each outlet.

3.2 INTERFACE WITH OTHER PRODUCTS

A. Coordinate installation of outlet box for products furnished under all Sections of these specifications.

B. Coordinate locations and sizes of required access doors with applicable sections in these specifications.

C. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

D. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.

E. Position outlet boxes to locate luminaires as shown on reflected ceiling plan.

3.3 ADJUSTING

A. Adjust flush-mounting outlets to make front flush with finished wall material.

B. Install knockout closure in unused box opening.

END OF SECTION

SECTION 26 05 35 - PULL AND JUNCTION BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the sections included under Division 1, General Requirements, are included as a part of this section as though bound herein.

1.2 SUMMARY

A. Provide and install pull and junction boxes as shown on drawings or as required by the National Electrical Code (NEC).

B. Provide and install pull and junction boxes wherever required for a complete and operating distribution system whether shown on drawings or not.

C. Where outlet boxes are used for pull and/or junction boxes, they shall meet the requirements of the outlet box section of these specifications.

1.3 REFERENCES

A. ANSI/NEMA FB 1 - Fittings and Supports for Conduit and Cable Assemblies.

B. ANSI/NEMA OS 1 - Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

C. ANSI/NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports.

D. ANSI/NFPA 70 - National Electrical Code.

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

1.4 SUBMITTALS

A. Submit actual shop drawings on all pull boxes showing.

1. Covers.
2. Dimensions - inside and out.
3. Rating of concrete or gauge of metal.
4. Manufacturer.

1.5 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations and mounting heights of pull and junction boxes.

1.6 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.7 PROJECT CONDITIONS

A. Verify field measurements are as shown on Drawings.

B. Verify locations of pull and junction boxes prior to rough-in.

C. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Install at location required for box to serve intended purpose and to maintain required access.

PART 2 - PRODUCTS

2.1 GENERAL

A. Dimensions of pull and junction boxes shall meet dimensions shown on drawings or dimensions required by NEC, whichever is largest.

B. Pull and junction boxes shall meet all requirements of UL and NEC.

C. Small pull boxes (i.e., 4" x 4") shall meet the requirements of these specifications for outlet boxes as a minimum.

D. All boxes (above ground) of 100 cubic inches or more shall be constructed of 14-gauge steel with hot dip galvanized coating.

2.2 SHEET METAL BOXES:

A. NEMA OS 1, galvanized steel (interior locations only).

B. Boxes to be fully weatherproof and watertight stainless steel NEMA 4SS where installed outside.

2.3 IN-GROUND PULL BOXES:

A. Material: Precast concrete, or composite.

B. Bottom: Open with 6 inches of gravel for drainage.

C. Cover: Meet Florida Dept. of Transportation requirements for installed location. (Pedestrian, heavy traffic, light traffic).

D. Solid sides constructed to facilitate conduit entries.

PART 3 - EXECUTION

3.1 GENERAL

A. Install per NEC.

B. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.

C. Install electrical boxes to maintain headroom and to present neat mechanical appearance.

D. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

E. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

F. Install boxes to preserve fire resistance rating of partitions and other elements.

G. Align adjacent wall-mounted boxes with each other.

H. Use flush mounting boxes in finished areas.

I. Do not install flush mounting boxes back-to-back in walls; provide minimum 6 inch separation. Provide minimum 24 inches separation in acoustic rated walls.

J. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

K. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

L. Pull and junction boxes larger than 25 square inches shall be supported with two 3/8 inch all-thread rod hangers minimum.

M. Do not fasten boxes to ceiling support wires.

N. Support boxes independently of conduit.

O. Large Pull Boxes: Boxes larger than 100 cubic inches (1600 cubic centimeters) in volume or 12 inches in any dimension.

1. Interior Dry Locations: Per NEC, with screw covers.

2. Other Locations: Use hinged enclosure under provisions of Section Cabinets and Enclosures.

P. Outdoor Locations: All boxes installed outdoors to be NEMA 4 Stainless Steel, fully weatherproof and watertight.

3.2 IN GROUND PULL BOXES

A. Provide and install ground rod in each pull box. Connect #2 copper ground wires (counterpoise) to ground rod, run out pull box 6 inches over conduits to next pull box; tie to respective building electrical ground rod at each building.

B. Install pull boxes flush with finished grade. Provide extensions as required.

3.3 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations and sizes of required access doors with applicable sections in these specifications.

B. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

3.4 ADJUSTING

A. Install knockout closure in unused box opening.

END OF SECTION

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SECTION 26 05 37 - SURFACE RACEWAYS

PART 1 - GENERAL

1.1 DESCRIPTION OF SYSTEM

A. Provide and install all equipment, labor, material, accessories, and mounting hardware for a complete operating system for the following:

1. Wireways.

1.2 REFERENCES

A. NECA (National Electrical Contractors Association) Standard of Installation.

1.3 SUBMITTALS

A. Submit under provisions of the General Requirements of the Contract Documents and Section Submittals.

B. Submit Product Data: Provide dimensions, knockout sizes and locations, materials, fabrication details, finishes, and accessories.

C. Submit Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with NECA Standard of Installation.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum 5 years’ experience.

1.6 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.1 WIREWAY

A. Manufacturers:

1. Hoffman.
2. Square "D"
3. Electrical Enclosures
4. Substitutions: Under provisions of Section Substitutions.

B. Description: General purpose, Oil tight and dust tight or Raintight type wireway as indicated on drawings. If not indicated provide type required to meet applicable codes.

C. Knockouts: Manufacturer's standard.

D. Size: As indicated on Drawings, or larger as required by the NEC

E. Cover: Hinged cover with full gasketing for raintight and oil tight types.

F. Connector: Slip-in for general purpose and raintight types and flanged for oil tight types.

G. Fittings: Lay-in type with removable top, bottom, and side; captive screws for general purpose, and drip shield for raintight type, and removable top for oil tight type.

H. Finish: Rust inhibiting primer coating with gray enamel finish.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install Products in accordance with manufacturer's instructions.

B. Use flat-head screws, clips, and straps to fasten raceway channel to surfaces. Mount plumb and level.

C. Use suitable insulating bushings and inserts at connections to outlets and corner fittings.

D. Wireway Supports: Provide steel channel as specified in Section Supporting Devices.

E. Close ends of wireway and unused conduit openings.

F. Ground and bond raceway and wireway under provisions of Section Grounding and Bonding.

G. Install only in locations deemed accessible by the NEC and local authority. Provide all access panels, etc., as required to maintain required access.

END OF SECTION

SECTION 26 05 38 - FLOOR BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the sections included under Division 1, General Requirements, are included as a part of this section as though bound herein.

1.2 SUMMARY

A. Furnish and install floor boxes as shown on the Drawings. Installation shall be in accordance with the NEC and shall be complete with service fittings as indicated. Equipment shall be listed by Underwriters Laboratories.

1.3 REFERENCE

A. ANSI/NEMA FB 1 Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable

B. ANSI/NFPA 70 National Electrical Code

C. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum).

D. Underwriters Laboratories Fire Resistance Directory - Current Publication Year

1.4 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories as suitable for purpose specified and shown.

C. Floor boxes shall be UL classified and listed to match fire rating of floor (minimum 2 hour fire rating).

1.5 SUBMITTALS

A. Submit under provisions of the General Requirements of the Contract Documents and Section 26 05 07, “Submittals”.

B. Submit catalog cut sheet on floor box with all accessories.

1.6 PROJECT RECORD DOCUMENTS

A. Submit under provisions of the General Requirements of the Contract Documents and Section 26 05 00, “Common Work Results”.

B. Accurately record actual locations of floor boxes.

1.7 PROJECT CONDITIONS

A. Verify field measurements are as shown on Drawings.

B. Verify locations of floor boxes and outlets in all areas prior to rough-in.

C. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Install at location required for box to serve intended purpose.

PART 2 - PRODUCTS

2.1 GENERAL

A. Each floor box to be complete with devices as called for on Drawings, complete with plates, trims, and accessories as required for a complete system.

B. Covers to be metal (unless specifically noted otherwise).

2.2 FLUSH IN FLOOR CAST IN PLACE CAST FLOOR BOXES

A. UL listed.

B. Threaded hubs.

C. Fully adjustable.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install floor boxes complete with all devices, accessories, etc. as recommended by manufacturer and to meet all applicable codes.

B. Adjust boxes as required for flush with floor installation.

C. Use cast floor boxes for installations in slab on grade with thread conduit hubs; formed steel boxes are acceptable for other installations.

D. Where floor or fill depth is 3 inches or more, adjustable boxes with maximum vertical and angular adjustment for after concrete pour shall be used. After pour is complete, boxes shall be set and readjusted to provide a smooth surface conforming to the elevation and slope of the surrounding finished floor.

E. In carpeted areas, Brass carpet flanges shall be installed to protect carpet edges where flush floor boxes are installed.

F. All assemblies shall be designed and installed to maintain grounding continuity, fireproofing and watertight integrity.

G. Box trim, service fittings and accessories shall be as specified on the drawings and/or as required for a complete and operational system.

H. Flush caps removed to install service fittings shall be turned over to the Owner.

I. Install floor boxes per UL Fire Resistance Directory. Do not exceed spacing and square foot area per unit requirements of specific product, UL fire resistance rating/classification for rating of floor.

END OF SECTION

SECTION 26 05 43 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Underground ducts, raceways, pull boxes, handholes, and accessories are required for complete functioning underground electrical and communications distribution system.

1.2 REFERENCE STANDARDS

A. See Section 01 42 00 - References for additional reference standards, definitions, abbreviations, and acronyms.

B. American Society of Testing materials (ASTM):

1. ASTM D1557-09: Standard Test Method for Laboratory Compaction characteristics of Soil Using Modified Effort (56,000ft-lbs/ft³ (2700Kn-m/m³)).
2. ASTM C136-06: Standard Test Method for Sieve Analysis of Fine and Course Aggregates.
3. ASTM C33-11a: Standard Specification for Concrete Aggregates.
4. ASTM C39-12a: Standard Test Method for Compressive Strength of Cylindrical Concrete.

C. National Electrical Contractors Association (NECA):

1. ANSI/NECA 1-2010: Standard Practice in Good Workmanship in Electrical Construction.

D. National Fire Protection Association (NFPA): NFPA 70 - National Electrical Code, 2023 Edition.

E. National Electrical Manufacturers Association (NEMA):

1. ANSI/NEMA TC2-2013: Electrical Polyvinyl Chloride (PVC) Conduit.
2. ANSI/NEMA TC3-2004: Electrical Polyvinyl Chloride (PVC) Fittings.

F. Occupational Safety and Health Administration (OSHA): Part 1926 - Safety and Health Regulations for Construction.

G. Florida Building Code and Trench Safety Act, 2010 Edition

1.3 SUBMITTALS

A. Comply with Section 01 33 00 - Submittal Procedures.

B. Product Data: Submit manufacturer's descriptive literature for each type of conduit, duct-bank, man, and hand holes, supports, components and accessories specified or indicated.

C. Stop Drawings:

1. Submit duct bank layouts for communications and electrical conduits, man and hand hole, conduit types, sizes, and location, with dimensions, and support points.
2. Drawings shall indicate floor plans and sections, drawn to scale and shall include:
   a. Relationships between underground ducts, components and adjacent structural, electrical, and communications interface elements.
   b. Vertical and horizontal offsets and transitions.
   c. Details of hand and manhole access to duct banks.
   d. Vertical elevations of duct-banks from grade, floor slab and adjacent structures.
3. Provide manufacturer's catalog data for duct-bank, man and handholes, and accessories required for complete installation.

D. Submit manufacturer's printed installation instructions for installation, including product storage, protection, and handling requirements.

E. Comply with Section 01 78 00 - Closeout Submittals: If variations from approved shop drawings occur during installation of duct-bank system, submit Project Record Documents indicating final locations.

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1.4 PROJECT COORDINATION

A. Comply with Section 01 31 00 - Project Coordination.

B. Contractor/CM shall coordinate pre-installation meeting with site work, communications, and electrical installers to plan, layout and install underground conduits, duct-banks, and man and handholes to avoid conflicts and interference with other trades.

C. Underground Utility Locating:

1. Provide Owner approved utility locating company to trace utilities to identifiable points.
2. Make visual inspection of site and locate existing underground utilities including electrical, gas, domestic water, chilled water, sewer, storm drainage, electrical, and telecommunications conduits, conductors, hand and pull hole locations.
3. Clearly mark underground utilities prior to excavation.
4. Immediately notify Contractor/CM if unmarked utilities are discovered. Stop work in area until utility can be identified. Notify Owner's Project Manager.

D. See Section 01 35 53 - Security Procedures for separation of work areas on existing operational facilities from of work site.

E. Worksite will have restricted access and may preclude use of heavy equipment, including backhoes, concrete trucks, utility, and other construction vehicles. Contractor/CM shall coordinate with Owner's Project Manager for specific restrictions and coordination with facility's on-going operations based on location of work.

F. During construction of underground ducts, Owner's Project Manager shall determine if closures of roads or spaces are possible at proposed dates and times. Coordinate work with Contractor/CM, and regulatory authority having jurisdiction for interface connections or activities.

G. Information from Owner on underground utility placement does not waive Contractor/ CM's responsibility from confirming presence and location of underground utilities in work area.

H. Contractor/CM shall provide necessary equipment to safely excavate and construct underground duct pathways. Comply with federal, state, and local regulations regarding work. Personal protective equipment, if required, shall be Contractor/CM's responsibility.

I. Comply with Florida Trench Safety Act, OSHA, and other applicable workplace regulatory requirements.

1.5 PROJECT REQUIREMENTS

A. During relocation of underground electrical and communications elements, services provided by or through system elements shall be minimally impacted. Service outages at occupied sites shall be minimized by scheduling work during off-hours to greatest extent possible. Service outages shall be coordinated with facility user and pre-approved by Owner's Project Manager.

B. Pathway routing shall avoid established trees. Small ornamental trees that interfere with work may be moved or replaced if preapproved by Owner's Project Manager. Planting beds and shrubs may be disrupted as needed, provided they are restored to original condition.

C. Walkways and roadway may be crossed if required, provided they are restored to original condition.

D. Where possible, new conduits installed along same pathway as existing pathway shall be installed as part of existing duct-bank. Contractor/CM may expose existing duct-bank and use its vertical side to frame space for new conduits.

E. Communications and data systems (fire alarm, intercom, telephones, sensors, cameras, etc.) may require dedicated cabling to specific, non-standard locations. See Division 27 specifications for additional requirements. Devices shall be designed as required and may run independent of other pathways and requirements. Owner's Project Manager shall preapprove pathway designs involving data, communications, security, or life-safety cabling.

F. Underground Pathways

1. Underground conduit structures are pathways used for placing building's electrical supply network between access points such as from electrical utility demark location to transformer, pull boxes and handholes, to site main electrical distribution room and between buildings.
2. Cable pathways shall be underground, where possible. Underground pathways shall be concrete-encased conduit.
3. Diameter of ducts shall be minimum of one-half trade size larger in diameter than diameter of largest anticipated cable.
4. Clearance between utilities:

UNDERGROUND CLEARANCES AS REQUIRED BY THE NESC	
Structure	Minimum Clearance
Communications or other low voltage	3" concrete encased conduit 4" masonry 12" of compacted earth
Pipes (e.g. gas, water, oil)	6" when crossing 12" when parallel
Telecommunications conduit terminated	Preferably 180 degrees but not on same pole as electrical, less than 90-degrees
NOTE: Check with Authority Having Jurisdiction for applicable codes. See NESC for other clearances.	

5. Underground pathways shall be designed for minimal depth of 30 inches to top of pathway elements. Deviations shall be pre-approved by Owner's Project Manager Authority Having Jurisdiction (AHJ).
6. Conduits may gradually slope up to under 30 inches depth to enter handholes or pull boxes.
7. Underground conduit elevations shall slope to allow drainage. Drain slope towards pull boxes or manholes at one percent grade.
8. Provide 12 inches fine aggregate compacted bed under duct bank and pull box locations.
9. Conduit layout in duct banks shall facilitate orderly cable racking within pull boxes to ensure minimal change in formation cable.
    a. Main conduit formations shall enter end walls of pull boxes approximately halfway between floor and top.
    b. Splay duct bank entrances at end walls rather than center placement.
    c. If total number of conduits being placed is significantly less than capacity of terminating pull box or cable entrance, conduits shall enter at lower level with upper space reserved for future conduits.
    d. Conduit entrance into pull boxes shall be sized for ultimate number of conduits to preclude future wall breakouts.
10. Curved duct bank sections shall be minimized. Where required, ducts shall be pre-manufactured with minimum 15 feet radii.
11. Duct bank configuration may vary, depending on spaces into which conduits end.

12. Buildings shall have minimum of four conduits accessing entrance facility. Two conduits shall be 4 inch (101 mm) inner diameter. Remaining two may be multi-cell conduits with minimum three factory-manufactured inner conduits.
13. Compacted backfill shall be fine aggregate grading in accord with ASTM C136-06 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates).
14. Backfill material may be material removed from original excavation, provided backfill materials meet ASTM C136-06.
15. Match sod of same type grass as surrounding area.
16. Compact first 6 inches of backfill to 95% density per ASTM D1557-09, Method A.
17. Compact second 6 inches of backfill to 85% density per ASTM D1557-09, Method A.
18. Horizontal conduits shall end flush with interior surface of pull boxes. Vertical conduit risers ending in electrical rooms shall extend 12 inches above concrete curb located at electrical switchgear. Cut conduits square and level to floor. Bushings shall be installed on conduit ends.
19. Provide compression-type duct plugs.
20. Install warning tape 24 inches above duct bank.
21. Provide #10 copper, green insulated tracer wire.
22. Install 0.375 inch diam. pull strings in conduits.

G Non-encasement

1. In special circumstances, if preapproved by Owner's Project Manager or where indicated, CM/Contractor may install conduits without concrete duct bank.
2. Typical installations may include parking lift gates, information kiosks, playfield ticket booths, concession stands or other non-critical locations.

1.6 DELIVERY, STORAGE, AND PROTECTION

A. Comply with Section 01 66 00, "Product Storage and Handling Requirements"

B. Store materials under cover and elevated above grade. Prevent water, dirt, and debris from entering conduits and tubing.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Approved Conduit Manufacturers:

1. IPEX, Inc.: 3 Place du Commerce, Suite 101, Ile-des-Soeurs, Verdun, Quebec, Canada H3E 1H7; Tel: 514-769-2200; Fax: 514-769-1672; Website: wwwipexinc.com.
   a. Product: TerraCon PVC raceway for directional boring and open trenching
2. Thomas and Betts, Inc., subsidiary of ABB Low Voltage Products Division; 8155 T & B Boulevard, Memphis, TN 38125; Tel: 800-816-7809; Website: www.carlon.com.
   b. Product: Carlon® Bore-Gard® and Boreable Multi-Gard Raceway for directional boring and open trenching.
3. Other manufacturers shall submit requests for product approvals in accord with Section 01 25 13, "Product Substitution Procedures:.

B. Conduit:

1. PVC SCH 40 Pipe.
   a. Manufactured to NEMA TC2 (Electrical Polyvinyl Chloride (PVC) Tubing and Conduit) specifications.
   b. Bell ends

c. Adhesive as recommended by conduit manufacturer for type of conduit providing permanent and watertight seal.

2. PVC SCH 40 Fittings.
   a. Manufactured to NEMA TC3 (PVC Fittings for Use with Rigid PVC Conduit and Tubing) specifications.
   b. Adhesive as recommended by conduit manufacturer for type of fitting providing permanent and watertight seal.
3. PVC SCH 40 Pre-Manufactured Sweeps.
   a. 6’ (1.83m) radius, minimum up to and including 90-degree sweeps.
   b. Sweeps greater than 90 degrees are not allowed.
4. PVC type EB-35.
   a. For use in encased concrete.
   b. Manufactured to NEMA TC8 (PVC Plastic Utilities Duct for Underground Installations) specifications.
   c. Bell ends.
   d. Adhesive as recommended by conduit manufacturer for type of fitting providing permanent and watertight seal.
5. PVC type EB-35 Fittings.
   a. For use in encased concrete.
   b. Manufactured to NEMA TC9 (Fittings for PVC Plastic Utilities Duct for Underground) specifications.
   c. Adhesive as recommended by conduit manufacturer for type of fitting providing permanent and watertight sea.

C. Conduit Spacers
1. Approved Manufacturer: Underground Devices, Inc., 3304 Commercial Ave., Northbrook, IL 60062; Tel: 847-205-9000; Fax: 847-205-9004; Website: www.udevices.com.
   a. Product: Underground Devices, Inc. WUNPEECE Spacer Type-4W20-2.
2. Other manufacturers shall submit requests for product approvals in accord with Section 01 25 13, “ Product Substitution Procedures”.

D. Conduit Plugs (compression-type plug).
1. Approved Manufacturer: Condux International Inc., 145 Kingswood Dr., PO Box 247, Mankato, MN 56002-0247; Tel: 800-533-2077; 507-387-6576; Fax: 501-387-1442; Website: www.condux.com.
   a. Product: 4 inch Nonmetallic Eye Nut Plug-08067840.
2. Other manufacturers shall submit requests for product approvals in accord with Section 01 25 13, “Product Substitution Procedures”.
3. Universal or “push-in” type plugs (e.g., Condux, Universal Plug-08047601) are not acceptable.

E. Conduit Seals.
   1. Approved Manufacturers:
      a. Tyco Electronics Corp., 8000 Purfoy Rd., Fuquay, NC 27526-9349; Tel: 919-557-8900; Fax: 919-557-8498; Website: www.tycoelectronics.com.
         i. Expandable sealing bags: Tyco T-DUX (based on conduit size).
      b. 3M Communication Markets Division, 6801 River Place Blvd., Austin, TX 78726- 9000; Tel: 800-426-8688; Website: www.3M.com/Telecom.
         i. Expanding foam: 3M Part #4416 Duct Sealant Kit.
   2. Other manufacturers shall submit requests for product approvals in accord with Section 01 25 13 – Product Substitution Procedures.
   3. Expanding foam insulation products (e.g., Great Stuff) are not acceptable.

F. Innerduct Conduits.
   1. Approved Manufacturer:
      a. Thomas and Betts, Inc., subsidiary of ABB Low Voltage Products Division; 8155 T & B Boulevard, Memphis, TN 38125; Tel: 800-816-7809; Website: www.carlon.com.
         i. Products:
            a) Carlon, Ribbed Wall High Density Polyethylene, 1.25” (3.18mm) OD, orange.
            b) Carlon, Corrugated High Density Polyethylene, 1.25” (3.18mm) OD, orange.
      b. Endot Industries, Inc., 60 Green Pond Rd., Rockaway, NJ 07866; Tel: 800-443-6368; Fax: 973-625-4087; Website: www.endot.com.
         i. Products:
            a) ENDOCOR corrugated, 1.25” (3.18mm) OD, orange.
      c. Other manufacturers shall submit requests for product approvals in accord with Section 01 25 13 – Product Substitution Procedures.

G. Pull Tape.
   1. Approved Manufacturer:
      a. Neptco, 30 Hamlet St., Pawtucket, RI 02861; Tel: 401-722-5500, 800-354-5445; Fax: 401-722-6328; Website: www.neptco.com.
         i. Product: RP1800P, 3/8” (86.5mm) width, 1800 lbs. (818kg) strength.
      b. Ideal Industries, Inc., Sycamore, IL 60178; Tel: 815-895-5181, 800-435-0705; Website: www.idealindustries.com.
         ii. Product: 3-in-1 Premise MULETAPE®, Cat. No. 31-315, 1,800 lb (818kg) pull strength.
      c. Other manufacturers shall submit requests for product approvals in accordance with Section 01 25 13 – Product Substitution Procedures.

H. Warning Tape.
   1. Manufacturer: Empire Level Mfg. Corp., 929 Empire Dr., Mukwonago, WI 53149; Tel: 800-558-0722; Fax: 262-368-2127; Website: www.empirelevel.com.
      a. Product: Thortec premium reinforced detectable underground orange warning tape, marked “Optic Fiber” or “Communications”.
      b. Other manufacturers shall submit requests for product approvals in accord with Section 01 25 13 – Product Substitution Procedures.

I. Tracer Wire: Green, 10 copper conductor insulated wire.

J. Concrete: 0.375 inches maximum size aggregate, nominal compressive strength, 3,000 psi (20.68Mpa) at 28 days.

K. Steel Reinforcing: #5 deformed bars, 40,000 lbs. (18,180kgs) tensile strength.

L. Sand for backfill clean, material passing #4 U.S. sieve, conforming to ASTM C33-11a - Standard Specification for Concrete Aggregates.

M. Manufacturers not listed shall comply with Section 01 25 13 Product Substitution Procedures.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Pathway routing shall avoid established trees. Small ornamental trees that interfere with the work may be moved or replaced if preapproved by Owner's Project Manager. Planting beds and shrubs may be disrupted as needed, provided they are restored to original condition.

B. Walkways and roadway may be crossed if required, provided they are restored to original condition.

C. Where possible, new conduits installed along same pathway as existing pathway shall be installed as part of existing duct bank. Contractor/CM may expose existing duct bank and use its vertical side to frame space for new conduits.

D. Communications and data systems (fire alarm, intercom, telephones, sensors, cameras, etc.) may require dedicated cabling to specific, non-standard locations. See other Div. 27 Specifications for additional requirements. Devices shall be designed as required and may run independent of other pathways and requirements. Owner's Project Manager shall preapprove pathway designs involving data, communications, security, or life-safety cabling.

E. Cable pathways shall be underground, where possible. Underground pathways shall be concrete-encased conduit.

F. Clearances between utilities:

Underground Clearances as Required by NESC	
Structure	Minimum Clearance
Communications or other low voltage 4" (100 mm) masonry 12" (300 mm) of compacted earth	3" (75 mm) concrete encased conduit
Pipes (e.g. gas, water, oil) when parallel	6" (150 mm) when crossing 12" (300 mm)
Telecommunications conduit terminated same pole as electrical	Preferably 180 degrees but not on less than 90 degrees
Underground pathways minimal depth	30" (76.2cm) to top of pathway elements.

G. Conduits shall slope at 1% grade for drainage between pull boxes and handholes.

H. Provide 12 inches fine aggregate compacted bed under duct bank and pull box locations.

I. Conduit Layout:

1. Layout in ductbanks shall facilitate orderly cable racking within pull boxes to ensure minimal change in formation cable.

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2. Main conduit formations shall enter end walls of pull boxes approximately halfway between floor and top.
3. Splay duct bank entrances at end walls rather than center placement.
4. If total number of conduits being placed is significantly less than capacity of terminating pull box or cable entrance, conduits shall enter at lower level with upper space reserved for future conduits.
5. Conduit entrance into pull boxes shall be sized for ultimate number of conduits to preclude future wall breakouts.
6. Duct bank change in directions shall be provided with pull hole boxes.
7. Duct bank configuration may vary, depending on spaces into which conduits end.
8. Buildings shall have minimum of four conduits accessing entrance facility. Two conduits shall be 4” (101 mm) inner diameter. Remaining two may be multi-cell conduits with minimum three factory-manufactured inner conduits.
9. Compacted backfill shall be fine aggregate grading in accord with ASTM C136-06 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates).
10. Backfill material may be material removed from original excavation, provided backfill materials meet ASTM C136-06.
11. Match sod of same type grass as surrounding area.
12. Compact first six inches of backfill to 95% density per ASTM D1557-09, Method A.
13. Compact second six inches of backfill to 85% density per ASTM D1557-09, Method A.
14. Horizontal conduits shall end flush with interior surface of pull boxes. Vertical conduit risers ending in electrical rooms shall extend 12” (304mm) above concrete curb located at electrical switchgear. Cut conduits square and level to floor. Bushings shall be installed on conduit ends.
15. Provide compression-type duct plugs.
16. Install warning tape 24” (60.8cm) above duct bank.
17. Provide #10 copper, green insulated tracer wire.
18. Install 0.375” (86.5mm) diam. pull strings in conduits.

J. Non-encasement
1. In special circumstances, if preapproved by Owner’s Project Manager or where indicated, CM/Contractor may install conduits without concrete duct bank.
2. Typical installations may include parking lift gates, information kiosks, playfield ticket booths, concession stands or other non-critical locations.

K. Digging and Trenching
1. Underground pathways shall be minimum depth of 30” (76.2 cm) to top of pathway elements.
2. Excavating and trenching shall be in accord with codes and requirements established by applicable local, state, and federal agencies and departments.
3. Trenching and digging shall be in neat and workmanlike manner.
4. Sawcut paved areas encountered during excavations. Cuts shall be neat and straight.
5. Remove excavated soil, rubble, debris, or other materials encountered during excavation. Excavated material to be reused may be stored on site with pre-approval of Owner’s Project Manager at designated location(s).
6. Excess material shall be properly removed from site per local disposal requirements.

7. Excavated material from duct bank trenches may be left near trenching to be used as backfill, if acceptable.
8. Only remove material necessary to safely and properly install duct banks.
9. Contact CM/Contractor and Owner's Project Manager immediately if trench or hole bottom is wet, unstable, or otherwise unable to support proposed infrastructure.
10. Provide pumps, as necessary, to keep water out of excavation. Direct effluent towards nearest storm drains only if effluent is free from dirt and debris. Otherwise, effluent shall be diverted to an area free from vehicular and pedestrian traffic and other construction areas.
11. Contractor/CM shall immediately notify Owner's Project Manager of rock that cannot be excavated by ¾ yard³ (0.51 m³) power shovel or broken sufficiently by air hammer to clear space required for infrastructure installation.

L. Backfill:
1. Notify Owner's Project Manager and Authority Having Jurisdiction (AHJ) prior to backfilling which will conceal installed pathway elements. Document pathway depths and locations.
2. Backfill in stages, when necessary to complete trenching and duct bank installation.
3. Use pre-excavation photographs or video recording of previous conditions to restore existing conditions, including brick walkway placement and pattern.
4. Restore brick walkways in same pattern and arrangement as originally installed.
5. Provide and install level layer of compacted fine aggregate over each encased duct bank.
6. First 12" (304mm) of aggregate bed shall be compacted to not less than 95% density per ASTM D1557-09, method A. Remaining fine aggregate fill to grade shall be compacted to not less than 85% density per ASTM D1557-09, method A.
7. Remove remainder of excavated material from site.
8. Remove erosion control devices no longer needed, not including those in and around seeded areas.
9. Compacted backfill shall be fine aggregate grading in accord with ASTM C136-06 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates).
10. Backfill material may be material removed from original excavation, provided backfill materials meets requirements of ASTM C136-06.

M. Protection:
1. Protect property from damage during construction. Restore, repair, rebuild, or replace damaged items adjacent property, existing fences, trees and shrubs, roadways and curbs, sidewalks, and surface utilities damaged during construction.
2. Provide traffic control elements to include barriers, tapes, barricades, signage, planking, decking and ramps to protect against unauthorized pedestrian or vehicular access to construction areas.
3. Provide temporary walkways to divert pedestrian traffic safely around construction area.
4. CM/Contractor shall request pre-approval from Owner's Project Manager for temporary driveway or walkway locations Protect, support, and maintain existing utilities in work area when encountered during excavation.
5. Install erosion control measures as needed to minimize erosion and to prevent soil run-off from construction area.
6. Provide and install bracing, shoring, and sheathing as necessary to protect facility staff, construction personnel and surrounding conditions. Adhere to local, state, and federal requirements for Trench Safety.

7. Hand removes and stack paving bricks and pavers and curbing on pallets in construction pathway.
8. Provide detailed photographic or video survey of pathways and areas to be disturbed prior to construction. Deliver set of photographs or video on flash drive to Owner's Project Manager prior to construction.
9. Workers shall use appropriate personal protective equipment to work safely within trenches and excavated areas. Provide appropriate safety equipment as needed to extract disabled workers or as otherwise needed to provide safe work environment and to provide immediate support in emergency situations.

N. Coordination and Scheduling:
1. Secure necessary construction permits, as required.
2. Coordinate construction schedules and work sequencing on site with facility operations and Owner's Project Manager.
3. Installer shall coordinate construction schedules with CM/Contractor.
4. Locate and stake pathways and spaces where work is to be installed. Confirm locations with Owner's Project Manager and A/E. CM/Contractor shall notify Owner's Project Manager of discrepancies in site plan and existing conditions.

O. Conduit/Duct Pathways Installation:
1. Pathway elements shall be labeled in accord with Section 26 05 53 – Identification for Electrical Systems.
2. Trench walls shall not be used as vertical forms for pouring concrete. Sides of trenches shall be formed to maintain straight and neat cross-section for duct banks to be encased by concrete. Remove forms after concrete sets.
3. When penetrating existing pull boxes or building walls, core-drill, or shall saw cut openings for access. Confirm with manufacturers or structural engineers that proposed method to access structure and final configuration of conduits shall not compromise structural integrity of structure.
4. Provide and install framing to prevent penetration of concrete into interior space of structure. Remove framing when concrete has set and after backfilling is complete.
5. Install horizontal conduits ending in structures flush with interior surface of wall.
6. Install vertical conduits endings in entrance facilities such that they extend minimum of 4" (101mm) above floor. Cut conduits square with conduit and not necessarily level to floor. Provide and install bushings on conduit ends.
7. Provide and install conduit spacers beneath each conduit three times per 20 linear ft. of conduit. Spacers shall be evenly distributed over each 20 segments (e.g., one at each 20 ft. joint and two evenly spaced over middle). Each horizontal row of spacers shall be installed with 6 inches (152 mm) minimum horizontal distance from other row of spacers to eliminate weak vertical shear planes.
8. Provide and install steel reinforcing bars, vertically and horizontally, to form box framing conduits. Coated wire shall be used to support rebar cage. Vertical and horizontal bars shall be tied to prevent movement and provide separation from conduits during concrete pouring. Vertical and horizontal bars shall be one-piece U-shaped bars prefabricated to extend around ducts to be located 3" (75mm) outside conduits. Provide 3" (75mm) cover to face of rebar.
9. Provide and install reinforcing bars as detailed. Rebar shall be secured to each other. Longitudinal bars shall overlap 12" (304mm), unless welded together, and shall be secured to vertical and horizontal bars to prevent movement or cage.

10. When abutting manholes or building walls, provide dowel holes in each structure to enable longitudinal reinforcing rods to penetrate structure far enough to prevent vertical and horizontal shearing of duct banks from structure. Do not penetrate walls with holes. Provide and install additional reinforcing rods to secure anchorage to manhole or wall openings.

P. Concrete Encasement

1. When encasing duct banks, provide and install concrete around conduits providing 3” (7.6 cm) of concrete around sides of conduit duct bank for areas indicated for complete encasement.
2. Shape top of concrete duct bank to slope water to edges.
3. Conduit encased in concrete shall have bell ends, joined with adhesive providing permanent and watertight seal.
4. Pathways including service entrance and inter-building pathways shall be encased in concrete. Concrete shall have maximum 0.375” (86.5mm) aggregate with nominal compressive strength of 3000 psi (20.68Mpa).
5. Separate rebar cage from conduits with 3” (7.6cm) concrete and provide 3” cover from rebar to top, sides and bottom of encasement.
6. Provide steel reinforcing bars, vertically and horizontally, to form vertical box framing conduits as indicated.

Q. Final Installation of New Pathway

1. Clean conduits by pulling cylindrical brushes until dirt is removed. Blow conduits dry.
2. Install pull strings into conduits.
3. Install tracer wire in one conduits of new pathway. In pull boxes, hand boxes, and entrance facilities, tracer wire shall be bonded to ground. Wire shall be clearly labeled in accord with Section 26 05 53, “Identification for Electrical Systems”.
4. In pull boxes and handholes, tracer wire shall loop up to be reachable without entering hole. Wire shall be securely anchored along neck, ceiling, and wall.
5. Install duct plugs at both ends of conduits.

R. Restoration

1. Restoration of disturbed landscaping shall be to preconstruction conditions per photographic or video records.

END OF SECTION

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SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the sections included under Division 1, General Requirements, are included as a part of this section as though bound herein.

1.2 SUMMARY

A. Provide and install all equipment, labor, and material for a complete identification system, including but not limited to:

1. Nameplates and labels.
2. Wire and cable markers.
3. Conduit markers.

1.3 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

B. Americans with Disabilities Act - 1990 including Amendments.

1.4 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.1 NAMEPLATES

A. Nameplates shall be laminated phenolic plastic, chamfer edges.

1. For 120/208 Volt System:
    a. Black front and back with white core, with lettering etched through the outer covering. White engraved letters on black background.
2. For 277/480 Volt System:
    a. Orange with white letters.
3. Emergency Power:
    a. Red front and back, white core, lettering etched through outer covering, white engraved letters on red background.

B. Nameplates for emergency power shall be laminated phenolic plastic. Red front and back, with white core, with lettering etched through outer covering, white engraved letters on red background.

C. Letter Size:

1. 1/8 inch letters for identifying individual equipment and loads.
2. 1/4 inch letters for identifying grouped equipment and loads.

D. Nameplates shall adequately describe the function of the particular equipment involved. Where nameplates are detailed on the drawings, inscription and size of letters shall be as shown and shop drawing submitted for acceptance. Nameplates for panelboards, switchboards, motor control centers, disconnects and enclosed breakers shall include the panel designation, voltage, and phase of the supply. For example, "Panel A, 120/208V, 3-phase, 4-wire". In addition, provide phenolic label in panels to describe where the panel is fed from and location. For example, "Fed From MDP-1:3:5 Electrical Room #E101 Level 1 inch. Nameplates for equipment listed below shall describe particular equipment name and associated panel/ckt (if applicable). The name of

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SECTION 26 05 73 - POWER SYSTEM STUDY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 1, General Requirements, are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. The requirements in this section of the specification are in addition to all requirements in sections referenced above.

B. This section includes the requirements for performing and submitting a system study on the complete power system and adjusting all breakers, devices, etc. according to the results of the study to provide a complete and properly coordinated power distribution system.

1.3 DESCRIPTION

A. Provide all labor, materials, and equipment necessary to perform a Power System Study properly and completely for the electrical distribution and control equipment and submit results in a report.

B. Electrical distribution and control equipment is to include switchboard(s), distribution panelboard(s), branch circuit panelboard(s), standby control equipment (panelboards, breakers, transfer switches, etc.) and other significant locations throughout the facility/premises.

C. The contractor shall be responsible for obtaining all required data of all equipment.

D. The Power System Study shall include coordination and short circuit study for the complete normal and standby power systems.

E. The study shall verify adequacy of all equipment implemented under these specifications and verify the correct application of circuit protective devices and other system components specified.

F. The study shall address the case when the system is being powered from the normal source as well as from the on-site generating source.

G. Minimum as well as maximum possible fault conditions shall be covered in the study.

H. Fault conditions of all motors shall be considered.

I. Adjust all breakers, devices, relays, etc. according to the results of the study to provide a complete and properly selective coordinated power distribution system.

1.4 SUBMITTALS

A. A summary of the short circuit analysis shall be submitted at the time shop drawings for all of the new equipment are submitted for approval.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit copy of study (in separate binder) with Operation and Maintenance Manual.

1.6 QUALITY ASSURANCE

A. Study shall be performed by a Florida Registered Professional Engineer.

1.7 REFERENCES AND REGULATORY REQUIREMENTS

A. Conform to the requirements of the following:

1. ANSI/NFPA 70 - National Electrical Code.
2. Applicable ANSI/IEEE standards.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 GENERAL

A. The manufacturer/contractor shall provide data necessary to perform the study. This includes feeder cable sizes, approximate feeder lengths, motor data, generator data, all overcurrent protective device data (including branches and main), protective relay settings, and any other information relevant to study.

B. All back-up calculations shall become part of the final report. The calculations shall be in sufficient detail to allow easy review.

3.2 CONTENTS

A. The Study shall include representation of the power company's system, the base quantities selected, impedance source data, calculation methods and tabulations, one-line diagram, impedance diagram, conclusions, and recommendations.

B. Short circuit momentary duties shall be calculated on the basis of an assumed bolted three-phase short circuit at each 480-volt bus, low voltage switchboard bus, switchboard, distribution panelboard, branch circuit panelboard, and other significant locations throughout the system.

C. A protective device time current coordination study shall be included with coordination plots of key and/or limiting devices, tabulated data, rating, and/or settings selected. The study shall present an engineering balance between the competing objectives of protection and continuity of service for the system specified, taking into account the basic factors of sensitivity, selectivity, and speed.

D. Separate plots shall be provided for each mode of "normal" and "stand-by" operation. Maximum fault values shall be shown in each case. Both power sources shown in one plot will not be accepted.

E. Generator short circuit decrement curves and thermal limit curves shall be included.

F. Required settings for breakers and relays shall be maximized to provide the most effective protection possible whether the system is fed from normal or emergency source.

G. Tabulations indicating recommended set points for all protective devices shall be provided. This shall include the normal as well as the emergency source.

3.3 MOTOR CURRENT –TIME CHARACTERISTIC CURVES

A. The contractor shall obtain from the motor supplier the necessary information to perform the study. Certified curves for "safe time versus current at 100 percent voltage" and "accelerating time versus current at 100 percent voltage" shall become part of the final report.

3.4 MOTOR STARTING STUDY

A. A motor starting study for motors rated 100 hp and larger to determine voltage dip or power inrush limitations at selected locations due to starting of motors shall be provided. This applies to both the normal and emergency mode.

3.5 GENERATOR PROTECTIVE DEVICES

A. The study shall address all of the protective devices provided for generator protection.

B. Protection relays requiring settings shall include, but not be limited to:

1. Differential
2. Overcurrent with Voltage Restraint
3. Ground
4. Undervoltage
5. Reverse Power
6. Unbalances Loading and Open Phase

7. Loss of Excitation.

3.6 TIME-CURRENT CURVE PRESENTATION

A. The coordination plots shall include complete titles, representative one-line diagrams, legends, associated power company's relay or system characteristics, significant motor staring characteristics, complete parameters for power and substation transformers, and complete operating bands for low-voltage circuit breaker trip devices.

B. The coordination plots shall define the types of protective devices selected, together with the proposed coil taps, time-dial settings and pick-up settings required.

C. The short-time region shall indicate the magnetizing in-rush, and ANSI withstand transformer parameters, the low-voltage circuit breaker instantaneous trip devices, fuse manufacturing tolerance bands, and significant symmetrical and asymmetrical fault currents.

D. Each primary protective device required for a delta-to-wye connected transformer shall be selected so that the characteristic or operating band is within the transformer parameters, which, where feasible shall include a parameter equivalent to 58 percent of the ANSI withstand point to afford protection for secondary line-to-ground faults.

E. Low-voltage power circuit breakers shall be separated from each other and the associated primary protective device, where feasible, by a 16 percent current margin for coordination and protection in the event of secondary line-to-line faults.

F. Protective relays shall be separated, where feasible, by a 0.3-second time margin when the maximum three-phase fault flows, to assure proper selectivity.

3.7 SUBMITTAL

A. The Study shall be submitted in a bound 8 ½" x 11" size report. Three (3) copies.

B. The final selection of all protective devices shall be based on preliminary draft of the coordination study, which shall be submitted with the equipment shop drawings for review.

C. The completed study shall be submitted to and accepted prior to shipping of any equipment.

D. All protective devices shall be adjusted, tested, and calibrated in the field prior to energizing the equipment, per the settings listed in the accepted study. This work shall be performed by the manufacturer prior to final acceptance by owner.

E. All protective devices shall be calibrated and tested as recommended by and under the supervision of the equipment manufacturer's representative.

END OF SECTION

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SECTION 26 09 23 - LIGHTING CONTROLS

PART 1: GENERAL

1.1 SUMMARY

A. Section includes a networked lighting control system comprised of the following components:
   1. System Software Interfaces
      a. Management and Visualization Interface
      b. Historical Database and Analytics Interface
      c. Personal Control Applications
      d. Smartphone Programming Interface for wired devices
   2. System Backbone and Integration Equipment
      a. System Controller
      b. OpenADR Interface
   3. Wired Networked Devices
      a. Wall Switches, Dimmers and Scene Controllers
      b. Graphic Wall Stations
      c. Auxiliary Input/Output Devices
      d. Occupancy and Photocell Sensors
      e. Power Packs and Secondary Packs
      f. Networked Luminaires
      g. Relay Panels
      h. Plug Load Controllers/Relays
      i. I/O Interface Relays.

B. The networked lighting control system shall meet all of the characteristics and performance requirements specified herein.

C. The contractor shall provide, install, and verify proper operation of all equipment necessary for proper operation of the system as specified herein and as shown on applicable drawings.

1.2. RELATED DOCUMENTS

A. Section 26 27 26 Wiring Devices.

B. Section 26 51 14 Interior Lighting Fixtures.

C. Section 26 56 00 Exterior Lighting.

1.3 SUBMITTALS

A. Submittal shall be provided including the following items:
   1. Bill of Materials necessary to install the networked lighting control system.
   2. Product Specification Sheets indicating general device descriptions, dimensions, electrical specifications, wiring details, and nomenclature.
   3. Riser Diagrams showing device wiring connections of system backbone and also typical per room/area type.
   4. Information Technology (IT) connection information pertaining to interconnection with facility IT networking equipment and third-party systems.
   5. Other Diagrams and Operational Descriptions – as needed to indicate system operation or interaction with other system(s).
   6. Contractor Startup/Commissioning Worksheet (must be completed prior to factory start-up).
   7. Service Specification Sheets indicating general service descriptions, including startup, training, post-startup support, and service contract terms.
   8. Hardware and Software Operation Manuals.

1.4 QUALITY ASSURANCE

A. Product Qualifications
   1. System electrical components shall be listed or recognized by a nationally recognized testing laboratory (e.g., UL, ETL, or CSA) and shall be labeled with required markings as applicable.
   2. System shall be listed as qualified under DesignLights Consortium Networked Lighting Control System Specification V2.0.
   3. System luminaires and controls are certified by manufacturer to have been designed, manufactured, and tested for interoperability.

4. All components shall be subjected to 100% end of line testing prior to shipment to the project site to ensure proper device operation.
5. All components and the manufacturing facility where product was manufactured must be RoHS compliant.

B. Installation and Startup Qualifications
1. System startup shall be performed by qualified personnel approved or certified by the manufacturer.

C. Service and Support Requirements
1. Phone Support: Toll free technical support shall be available.
2. Remote Support: The bidder shall offer a remote support capability.
3. Onsite Support: The bidder shall offer onsite support that is billable at whole day rates.
4. Service Contract: The bidder shall offer a Service Contract that packages phone, remote, and onsite support calls for the project. Response times for each type of support call shall be indicated in the terms of the service contract included in the bid package.

1.5 WARRANTY

A. The manufacturer shall provide a minimum five-year warranty on all hardware devices supplied and installed. Warranty coverage shall begin on the date of shipment.
B. The hardware warranty shall cover repair or replacement any defective products within the warranty period.

1.6 MAINTENANCE & SUSTAINABILITY

A. The manufacturer shall make available to the owner new parts, upgrades, and/or replacements available for a minimum of 5 years following installation.

PART 2: EQUIPMENT

2.1 MANUFACTURERS

A. Acuity
B. Hubbell
C. Eaton
D. Legrand

2.2 SYSTEM PERFORMANCE REQUIREMENTS

A. System Architecture
1. System shall have an architecture that is based upon three main concepts: (a) networkable intelligent lighting control devices, (b) standalone lighting control zones using distributed intelligence, (c) optional system backbone for remote, time based and global operation between control zones.
   a. Intelligent lighting control devices shall have individually addressable network communication capability and consist of one or more basic lighting control components: occupancy sensor, photocell sensor, relay, dimming output, contact closure input, analog 0-10V input, and manual wall station capable of indicating switching, dimming, and/or scene control. Combining one or more of these components into a single device enclosure shall be permissible so as to minimize overall device count of system.
   b. Lighting control zones consisting of one or more networked luminaires and intelligent lighting control devices and shall be capable of providing automatic control from sensors (occupancy and/or photocell) and manual control from local wall stations without requiring connection to a higher level system backbone; this capability is referred to as “distributed intelligence.”
   c. System must be capable of interfacing directly with networked luminaires such that either low voltage network cabling or wireless RF communication is used to interconnect networked luminaires with control components such as sensors, switches, and system backbone (see *Control Zone Characteristics* sections for each type of network connection, wired or wireless).
2. The system shall be capable of providing individually addressable switching and dimming control of the following: networked luminaires, control zones to include multiple switch legs or circuits, and relay and dimming outputs to provide design flexibility appropriate with sequence of operations required in each project area or typical space type. A single platform shall be used for both indoor and outdoor lighting controls.

3. Lighting control zones shall be capable of being networked with a higher level system backbone to provide time based control, remote control from inputs and/or systems external to the control zone, and remote configuration and monitoring through a software.
4. All system devices shall support remote firmware update, such that physical access to each device is not necessary, for purposes of upgrading functionality at a later date.
5. System shall be capable of “out of box” sequence of operation for each control zone. Standard sequence is:
   a. All switches control all fixtures in a zone
   b. All occupancy sensors automatically control all fixtures in the control zone with a default timeout.

B. Wired Networked Control Zone Characteristics
1. Following proper installation and provision of power, all networked devices connected together with low voltage network cable shall automatically form a functional lighting control zone without requiring any type of programming, regardless of the programming mechanism (e.g., software application, handheld remote, pushbutton). The “out of box” default sequence of operation is intended to provide typical sequence of operation so as to minimize the system startup and programming requirements and to also have functional lighting control operation prior to system startup and programming.
2. System shall be able to automatically discover all connected devices without requiring any provisioning of system or zone addresses.
3. The following types of wired networked control devices shall be provided for egress and/or emergency light fixtures:
   a. Low-Voltage power sensing: These devices shall automatically provide 100% light level upon detection of loss of power sensed via the low voltage network cable connection.
   b. UL924 Listed Line-Voltage power sensing: These devices shall be listed as emergency relays under the UL924 standard and shall automatically close the load control relay(s) and provide 100% light output upon detection of loss of power sensed via line voltage connections.
   c. Emergency egress devices shall be provided and UL labeled by the lighting control manufacturer.

C. System Integration Capabilities
1. The system shall interface with third party building management systems (BMS) to support two-way communication using the industry standard BACnet/IP or BACnet/MSTP protocols.

2.3 SYSTEM SOFTWARE INTERFACES

A. Management Interface:
1. System shall provide a web-based management interface that provides remote system control, live status monitoring, and configuration capabilities of lighting control settings and schedules.
2. Management interface must be compatible with industry-standard web browser clients, including, but not limited to, Microsoft Internet Explorer®, Apple Safari®, Google Chrome®, Mozilla Firefox®.
3. All system software updates must be available for automatic download and installation via the internet.

B. Historical Database and Analytics Interface
1. System shall provide a browser-based trending and monitoring interface that stores historical data for all occupancy/daylight sensors and lighting loads. Additionally, the system shall optionally upload that data to a cloud-based server.

C. Visualization Interfaces
1. System shall provide an optional web-based visualization interface that displays a graphical floorplan. System data, to include status of occupancy sensors, daylight sensors and light output shall be overlaid to the floorplan to provide a graphical status page.

D. Portable Programming Interface for Standalone Control Zones
1. Portable handheld application interface for standalone control zones shall be provided for systems that allows configuration of lighting control settings.

2. Programming capabilities through the application shall include, but not be limited to, the following:
    a. Switch/occupancy/photosensor group configuration
    b. Manual/automatic on modes
    c. Turn-on dim level
    d. Occupancy sensor time delays
    e. Dual technology occupancy sensors sensitivity
    f. Photosensor calibration adjustment and auto-setpoint
    g. Trim level settings.

2.4 SYSTEM BACKBONE AND SYSTEM INTEGRATION EQUIPMENT

A. System Controller
1. System Controller shall be a multi-tasking, real-time digital control processor consisting of modular hardware with plug-in enclosed processors, communication controllers, and power supplies.
2. System Controller shall perform the following functions:
    a. Facilitation of global network communication between different areas and control zones.
    b. Time-based control of downstream wired and wireless network devices.
    c. Linking into an Ethernet network.
    d. Integration with Building Management Systems (BMS) and Heating, Ventilation and Air Conditioning (HVAC) equipment.
    e. Connection to various software interfaces, including management interface, historical database and analytics interface, visualization interface, and personal control applications.
3. System Controller shall not require a dedicated PC or a dedicated cloud connection.
4. Device shall automatically detect all networked devices connected to it, including those connected to wired and wireless communication bridges.
5. Device shall have a standard and astronomical internal time clock.
6. Shall be capable of connecting to the customers Local Area Network (LAN) via IEEE 802.11.x Wireless and IEEE 802.3 Wired connection.
7. System Controller shall support BACnet/IP and BACnet/MSTP protocols to directly interface with BMS and HVAC equipment without the need for additional protocol translation gateways.
    a. BACnet/MSTP shall support a minimum of 50 additional BACnet MS/TP controllers in addition to the Expansion I/O modules.
    b. BACnet/MSTP shall support 9600 to 115200 baud.
    c. System Controller shall be BACnet Testing Laboratory (BTL listed) using Device Profile BACnet Building Controller (B-BC) with outlined enhanced features.
    d. System controller must support BACnet/IP Broadcast Management Device (BBMD) and Foreign Device Registration (FDR).

B. Open ADR Interface
1. System shall provide an interface to OpenADR protocol Demand Response Automation Servers (DRAS) typically provided by local electrical utility.
2. OpenADR interface shall meet all of the requirements of Open ADR 2.0a Virtual End Nodes (VEN), including:
    a. Programmable with the account information of the end-user’s electrical utility DRAS account credentials.

2.5 WIRED NETWORKED DEVICES

A. Wired Networked Wall Switches, Dimmers, Scene Controllers
1. Wall switches & dimmers shall support the following device options:
    a. Number of control zones: 1, 2 or 4
    b. Control Types Supported: On/Off or On/Off/Dimming
2. Scene controllers shall support the following device options:
    a. Number of scenes: 1, 2 or 4
    b. Control Types Supported:
        1) On/Off or On/Off/Dimming
        2) Preset Level Scene Type

3) Reprogramming of other devices within daisy-chained zone so as to implement user selected lighting scene
4) Selecting a lighting profile to be run by the system's upstream controller so as to implement a selected lighting profile across multiple zones.

B. Wired Networked Graphic Wall Stations
1. Device shall have a full color touch screen.
2. Device shall enable configuration of all switches, dimmers, and lighting preset scenes via password protected setup screens.
3. Graphic wall stations shall support the following device options:
a. Number of control zones: Minimum of 16
b. Number of scenes: Minimum of 16
c. Optional password protection for setup screens.

C. Wired Networked Auxiliary Input / Output (I/O) Devices
1. Auxiliary Input/Output Devices shall be specified as an input or output device with the following options:
a. Contact closure input
1) Input shall be programmable to support maintained or momentary inputs that can activate local or global scenes and profiles, ramp light level up or down, or toggle lights on/off.
b. 0-10V analog input
1) Input shall be programmable to function as a daylight sensor.
c. RS-232/RS-485 digital input
1) Input supports activation of up to 4 local or global scenes and profiles, and on/off/dimming control of up to 16 local control zones.
d. 0-10V dimming control output, capable of sinking a minimum of 20mA of current
1) Output shall be programmable to support all standard sequence of operations supported by system.

D. Wired Networked Occupancy and Photosensors
1. Sensors shall utilize passive infrared (PIR) or passive dual technology (PDT) to detect both major and minor motion as defined by NEMA WD-7 standard.
2. Sensing technologies that are acoustically passive, meaning they do not transmit sounds waves of any frequency do not require additional commissioning. Ultrasonic or Microwave based sensing technologies may require commissioning due to the active nature of their technology if factory required.
3. Sensor programming parameter shall be available and configurable remotely from the software and locally via the device.
4. Sensor mounting type shall match project design requirements as shown on plans.
a. Sensors shall have optional features for photosensor/daylight override, dimming control, and low temperature/high humidity operation.
5. The system shall support the following types of photocell-based control:
a. On/Off: The control zone is automatically turned off if the photocell reading exceeds the defined setpoint and automatically turned on if the photocell reading is below the defined setpoint. A time delay or adaptive setpoint adjustable behavior may be used to prevent the system from exhibiting nuisance on/off switching.
b. Continuous Dimming: The control zone automatically adjusts its dimming output in response to photocell readings, such that a minimum light level consisting of both electric light and daylight sources is maintained at the task. The photocell response shall be configurable to adjust the photocell setpoint and dimming rates. Fall off shall be achievable.

E. Wired Networked Wall Switch Sensors
1. Wall switches sensors shall support the following device options:
a. User Input Control Types Supported: On/Off or On/Off/Dimming.
b. Occupancy Sensing Technology: Dual Tech.
c. Daylight Sensing Option: Inhibit Photosensor.

F. Wired Networked Embedded Sensors
   1. Embedded sensors shall support the following device options:
      a. Occupancy Sensing technology: PIR only or Dual Tech.
      b. Daylight Sensing Option: Occupancy only, Daylight only, or combination Occupancy/Daylight sensor.
G. Distributed System Power, Switching and Dimming Controls
   1. Devices shall incorporate one optional Class 1 relay, optional 0-10 VDC dimming output, and contribute low voltage Class 2 power to the rest of the system.
   2. Device programming parameters shall be available and configurable remotely from the software and locally via the device push-button.
   3. Device shall be plenum rated.
   4. Devices shall be UL Listed for load and load type as specified on the plans.
H. Wired Networked Luminaires
   1. Networked luminaire shall have a factory installed mechanically integrated control device and carry a UL Listing as required.
   2. Networked LED luminaire shall provide low voltage power to other networked control devices.
   3. System shall be able to maintain constant lumen output over the specified life of the LED luminaire (also called lumen compensation) by automatically varying the dimming control signal to account for lumen depreciation.
   4. System shall be able to provide control of network luminaire intensity.
   5. Controls manufacturer is responsible for primary troubleshooting and tech support of complete fixture.
I. Wired Networked Relay Panel
   1. Relay panel(s) shall be capable of providing the required amount of relay capacity, as required per drawing.
   2. Standard relays used shall have the following required properties:
      a. Configurable in the field to operate with normally closed or normally open behavior.
      b. Provides visual status of current state and manual override control of each relay.
      c. Be individually programmable
   3. Panel shall be UL924 listed for control of emergency lighting circuits.
   4. Panel shall provide a contact closure input that acts as a panel override to activate the normally configured state of all relays (i.e., normally open, or normally closed) in the panel.

PART 3: EXECUTION

3.1 INSTALLATION REQUIREMENTS

A. Installation Procedures and Verification
   1. The successful bidder shall review all required installation and pre-startup procedures with the manufacturer’s representative through pre-construction meetings.
   2. The successful bidder shall install and connect the networked lighting control system components according to the manufacturer’s installation instructions, wiring diagrams, the project submittals, and plans specifications.
   3. The successful bidder shall be responsible for testing of all low voltage network cable included in the bid. Bidder is responsible for verification of the following minimum parameters:
      a. Wire Map (continuity, pin termination, shorts, and open connections, etc.)
      b. Length
      c. Insertion Loss.
B. Coordination with Owner’s IT Network Infrastructure
   1. The successful bidder is required to coordinate with the owner’s representative to secure all required network connections to the owner’s IT network infrastructure.
      a. The bidder shall provide to the owner’s representative all network infrastructure requirements of the networked lighting control system.
      b. The bidder shall provide, to the manufacturer’s representative, all necessary contacts pertaining to the owner’s IT infrastructure, to ensure that the system is properly connected and started up.

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C. Coordination with Mechanical Division
   1. The successful bidder shall provide all integration equipment and programming to achieve operation and functionality detailed in Divisions 23 and 26.
   2. The successful bidder to verify integration scope with the Mechanical Contractor prior to submittal phase and provide all necessary coordination.

D. Documentation and Deliverables
   1. The installing contractor shall be responsible for documenting installed location of all networked devices, including networked luminaires. This includes responsibility to provide as-built plan drawing showing device addresses corresponding to locations of installed equipment.
   2. The installing contractor is also responsible for the following additional documentation to the manufacturer's representative for visualization / graphical floorplan software to be provided as part of bid package:
      a. As-Built floor plan drawings showing wired network control zones outlined, in addition to device address locations required above. All documentation shall remain legible when reproducing\scanning drawing files for electronic submission.
      b. As-Built electrical lighting drawings (reflected ceiling plan) in PDF and CAD format. Architectural floor plans shall be based on as-built conditions.
         1) CAD files shall have layers already turned on/off as desired to be shown in the graphical floorplan background images. The following CAD elements are recommended to be hidden to produce an ideal background graphical image: Titleblock.
         2) Text- Inclusive of room names and numbers, fixture tags and drawings notes
            Fixture wiring and homeruns
            Control devices
         3) Hatching or poché of light fixtures or architectural elements
         4) CAD files shall be of AutoCAD 2013 or earlier. Revit file overall floor plan views shall be exported to AutoCAD 2013.

3.2 SYSTEM STARTUP

A. Upon completion of installation by the installer, including completion of all required verification and documentation required by the manufacturer, the system shall be started up and programmed by an authorized representative of the manufacturer.
   1. Low voltage network cable testing shall be performed prior to system startup at the discretion of the manufacturer.

B. System start-up and programming shall include:
   1. Verifying operational communication to all system devices.
   2. Programming the network devices into functional control zones to meet the required sequence of operation.
   3. Programming and verifying all sequence of operations.
   4. Customization of owner's software interfaces and applications.
   5. Commissioning secured by the contractor and performed by manufacturer's representative. Provide commissioning report for each space control functional testing required per Florida Building Energy Code.

C. Initial start-up and programming is to occur on-site. Additional programming may occur on-site or remotely over the Internet as necessary.

3.3 PROJECT TURNOVER

A. System Documentation
   1. Submit software database file with desired device labels and notes completed.

B. Owner Training
   1. Provisions for onsite training for owner and designated attendees to be included in submittal package.

END OF SECTION

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SECTION 26 10 12 - 600 VOLT ELECTRICAL AND SYSTEMS SERVICE ENTRANCE

PART 1 - GENERAL

1.1 SESSION INCLUDES:

A. Arrangement with Utility Company for permanent electric service.

B. Arrangement with Utility Company for permanent telco service.

C. Arrangement with Utility Company for permanent CATV service.

D. Underground service entrance.

1.2 SYSTEM DESCRIPTION

A. Power:

1. System Voltage: 23,000 volts, three phase, four-wire, 60 Hertz.
2. Service Entrance: Main

B. Telecommunications:

1. Coordinate actual telecom services to be installed with Owner.

C. Cable Television (CATV):

1. Coordinate actual telecom services to be installed with Owner.

1.3 QUALITY ASSURANCE

A. Power Utility Company: Florida Power and Light.

B. Telecommunications Utility Company: AT&T, County Fiber.

C. CATV: Comcast/Xfinity.

D. Install service entrance in accordance with Utility Company's rules and regulations.

1.4 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 01300.

B. Submit Utility Company prepared drawings.

PART 2 - PRODUCTS

2.1 POWER METERING EQUIPMENT

A. Meter; meter base and transformer cabinet.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Power:

1. Make arrangements with Utility Company to obtain electric service to the Project.
2. Underground: Install service entrance conduits at a minimum depth of 36 inches from Utility Company's switch cabinet and primarily metered equipment. Utility Company will connect service lateral conductors to service entrance conductors.
3. Provide concrete pad and switch cabinets.
4. Install primary conduits (conduits furnished by Utility Company) from project’s property line as determined by Utility Company to switch cabinet. Locate conduits at a minimum depth of 36 inch; cover conduits with three inches thick by trench width concrete and warning tape.

B. Telecommunications:

1. Make arrangements with Utility Company to obtain telco service to the project.
2. Underground: Provide and install service entrance conduits at a minimum depth of 36 inches from utility pole or service cabinet. Utility company will provide and install service

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lateral conductors and terminate on surge device to serve as the customer interface/demarcation point.

C. CATV:

1. Make arrangements with Utility Company to obtain CATV service to the project.
2. Underground: Provide and install service entrance conduits at a minimum depth of 36 inches from utility pole or service cabinet. Utility company will provide and install service lateral conductors and terminate on surge device to serve as the customer interface/demarcation point.

END OF SECTION

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SECTION 26 22 13 - DRY TYPE TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the sections included under Division 1, General Requirements, are included as a part of this section as though bound herein.

1.2 SUMMARY

A. Provide and install all equipment, labor, material, accessories, and mounting hardware for a complete operating system for energy efficient drytype transformers per TP-1.

1.3 REFERENCES:

A. NEMA TP-1

B. UL 1561

C. CSA C22.

D. NECA National Electrical Contractors Association

E. NEMA ST 1 - Specialty Transformers

F. NEMA ST 20 - Dry Type Transformers for General Applications.

G. NFPA 70 - National Electrical Code.

1.4 SUBMITTALS

A. Submit Product Data: Provide outline and support point dimensions of enclosures and accessories, unit weight, voltage, kVA, and impedance ratings and characteristics, tap configurations, insulation system type, and rated temperature rise.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with NECA Standard of Installation.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum five years' experience.

1.7 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by UL as suitable for purpose specified and shown.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store, protect, and handle products to site.

B. Deliver transformers individually wrapped for protection and mounted on shipping skids.

C. Accept transformers on site. Inspect for damage.

D. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

E. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

PART 2 - PRODUCTS

2.1 TWO-WINDING TRANSFORMERS

A. Manufacturers:

1. Square D (Basis of Design)

2. G.E.
3. Eaton
4. Siemens

B. Description: NEMA ST 20, factory-assembled, air cooled dry type transformers, ratings as indicated.

C. Insulation system and average winding temperature rise for rated kVA as follows:
1. 1-15 kVA: Class 185 with 115-degrees C rise.
2. 16-500 kVA: Class 220 with 115-degrees C rise.

D. Case temperature: Do not exceed 35-degrees C rise above ambient at warmest point.

E. Winding Taps:
1. Transformers Less than 15 kVA: Two 5 percent below rated voltage, full capacity taps on primary winding.
2. Transformers 15 kVA and Larger: NEMA ST 20.

F. Sound Levels: NEMA ST 20.

G. Basic Impulse Level: 10 kV.

H. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.

I. Mounting: Suitable for wall, floor, or trapeze mounting, except transformers larger than 75 KVA, suitable for floor or trapeze mounting.

J. Coil Conductors: Continuous windings with terminations brazed or welded.

K. Transformer windings shall be continuous wound copper (98% conductivity) construction.

L. Enclosure: NEMA ST 20; Type 1 or Type 3R ventilated as indicated. Provide lifting eyes or brackets.

M. Isolate core and coil from enclosure using vibration-absorbing mounts.

N. Nameplate: Include transformer connection data.

2.2 SOURCE QUALITY CONTROL

A. Provide testing of transformers under provisions of Section Hangers and Supports.

B. Provide production testing of each unit in accordance with NEMA ST 20.

2.3 K RATED TRANSFORMERS

A. Provide double-sized neutral terminals for additional neutral cables.

B. For K rating of transformers, refer to Power Riser Diagram in the Contract Documents. If not listed, provide K-13 rating.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify site condition.

B. Verify that surfaces are suitable for installing transformer supports.

3.2 PREPARATION

A. Provide concrete pad sized minimum of 3 inches larger on all sides of the transformer.

3.3 INSTALLATION

A. Install Products in accordance with manufacturer's instructions.

B. Set transformer plumb and level.

C. Use flexible conduit, under the provisions of Section Conduit, 1 foot minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.

D. Mount transformers on vibration isolating pads suitable for isolating the transformer noise from the building structure.

E. Provide grounding and bonding in accordance with section Grounding and Bonding.

F. Ground per NEC 250-26 and all applicable codes per authority havingjurisdiction.

3.4 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed.

B. Check for damage and tight connections prior to energizing transformers.

C. Measure primary and secondary voltages and make appropriate tap adjustments.

END OF SECTION

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SECTION 26 24 13 - DISTRIBUTION SWITCHBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the sections included under Division 1, General Requirements, are included as a part of this section as though bound herein.

1.2 SUMMARY

A. Description of System:

1. Factory-assembled, metal-enclosed switchboard for distribution and control of power from incoming line terminals to outgoing feeder terminals, installed and tested in place.
2. Switchboard shall include all protective devices and equipment as listed on drawings or as included in these specifications, with necessary interconnections, instrumentation, and control wiring.

1.3 REFERENCES AND REGULATORY REQUIREMENTS

A. The switchboard(s) and overcurrent protection devices referenced herein are designed and manufactured according to the following appropriate specifications

1. ANSI/NFPA 70 National Electrical Code (NEC)
2. ANSI/IEEE C12.16 – Solid State Electricity Metering
3. ANSI C57.13 – Instrument Transformers
4. NEMA AB1 – Molded Case Circuit Breakers and Molded Case Switches, and Circuit Breaker Enclosures
5. NEMA PB2 – Deadfront Distribution Switchboards, File E8681
6. NEMA PB2.1 – Proper Handling, Installation, Operation and Maintenance of Deadfront Switchboards Rated 600 Volts or Less
7. NEMA PB2.2 – Application Guide for Ground Fault Protective Devices for Equipment.
8. UL50 – Cabinets and Boxes
9. UL98 – Enclosed and Dead Front Switches
10. UL 489 – Molded Case Circuit Breakers
11. UL 891 – Deadfront Switchboards
12. UL 943 – Ground Fault Circuit Interrupters
13. Federal Specification W-C 375D Circuit Breakers, Molded Case, Branch Circuit and Service

1.4 SUBMITTALS

A. Shop Drawings and Product Data:

1. Shop Drawings:
    a. Layouts showing concrete pad dimensions conduit entrance and available space, bus duct connections, electrical ratings, nameplate nomenclature, and single-line diagrams in accordance with ANSI Y32.2 indicating connections and controls.
    b. Shop Drawings shall clearly indicate:
        i. Frame sizes and Interrupting Capacity of each breaker, and total assembly.
        ii. Horsepower ratings at rated voltage of fused switches and/or breakers.
        iii. Type of labels and labeling for every device and what it feeds.

iv. Nameplate on main switchboard only giving name of project; Architect, Engineer, and contractor.

v. Bus bar size, arrangement and spacing.

2. Product Data:

a. Manufacturer's written recommendations for storage and protection, installation instructions and field test requirements.

B. Test Reports:

1. Reports of production and field tests.

C. Operations and Maintenance Data:

1. Manufacturer's instructions for tightening bus connections, performing cleaning, and operating and maintaining switchboard.

PART 2 - PRODUCTS

2.1 GENERAL

A. Switchboards with circuit breakers and branch protective devices shall comply with NEMA PB2 as a minimum requirement. Switchboard shall be NEMA Class II, Type I construction and shall meet Underwriter's Laboratories enclosure requirements for service conditions.

B. Each cubicle shall have UL Label affixed, unless special construction prohibits, and no labeling or listing is available.

C. The sides and tops shall be covered with removable screw-on code gauge steel plates.

D. Switchboards shall be completely self-supporting structures, 90 inches high.

E. Provide lugs on bus, distribution panelboard and circuit breakers as required to match conductors being connected/terminated.

2.2 FINISH

A. All steel surfaces shall be chemically cleaned and treated to provide a bond between paint and metal surfaces to help prevent the entrance of moisture and formation of rust under the paint film.

B. The switchboard exterior shall be finished in indoor light grey No. 61, ANSI Z55.1.

C. Apply corrosion-protective undercoating to undersurfaces.

2.3 BUSSING AND TERMINATIONS

A. Bus bars:

1. Buses shall be tin-plated copper sized per UL 891.

2. The bus structure shall be braced to withstand mechanical forces exerted during short circuit conditions when connected directly to a power source having minimum 65,000 amps symmetrical short circuit current.

3. A ground bus shall be furnished secured to each vertical section structure.

B. Bus connections shall be accessible from front & front connected.

C. Where space for future is called for on drawings, all necessary buses except device connecting straps shall be furnished.

D. Line and load terminations shall be provided suitable for the size, number or conductors, and conductor material. Terminations shall be accessible from the front.

E. Provide full height wiring gutter doors for quick access to wiring terminals.

F. All hardware shall have high tensile strength and have a suitably protective finish.

2.4 ACCESSORIES

A. Switchboard shall be provided with adequate lifting means and shall be capable of being rolled or moved into installation position and bolted directly to the floor without the use of floor sills.

2.5 MAIN/DISTRIBUTION SECTION

A. Main device shall be as called for on drawings.

B. Circuit breaker, fusible switch, or current limiting branch circuit breaker protective devices shall be group-mounted with necessary connections accessible from the front.

C. Provide Electronic Power Metering with capabilities to transmit kW, kWh, amps, and peak demand via DDC open protocol translator, coordinate with BCS contractor. Basis of Design: Square D - PM800 Series.

D. All breakers 1200A or greater shall have arc-fault incident energy mitigation switching.

2.6 ACCEPTABLE MANUFACTURERS

A. Square D (Basis of Design)

B. G.E.

C. Eaton

D. Siemens

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine area to receive switchboard to assure adequate clearance for switchboard installation.

B. Check that concrete pads are level and free of irregularities.

C. Start work only after unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Install switchboard in accordance with manufacturer's written instructions, and NEC.

B. Mount switchboard on 3 inch concrete base extending 3 inches outside all sides.

3.3 ADJUSTMENT AND CLEANING

A. Adjust operating mechanisms for free mechanical movement.

B. Tighten bus connections and mechanical fasteners.

C. Touch-up scratched or marred surfaces to match original finish.

END OF SECTION

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SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the sections included under Division 1, General Requirements, are included as a part of this section as though bound herein.

1.2 SUMMARY

A. Provide all labor, materials, and equipment necessary to install panelboards properly and completely as scheduled on the drawings and as required by this section.

1.3 REFERENCES

A. NECA (National Electrical Contractors Association) "Standard of Installation."

B. NEMA AB 1 - Molded Case Circuit Breakers.

C. NEMA PB 1 - Panelboards.

D. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

E. NFPA 70 - National Electrical Code.

F. UL 67 - Panelboards

G. UL 50 Enclosures for Electrical Equipment

H. UL 489 Molded Case Circuit Breakers and Circuit Breaker Enclosures

I. Federal Specification W-P-115C – Type I Class I

J. Federal Specification W-C-375 B/GEN - Circuit Breakers, Molded Case, Branch Circuit and Service.

1.4 SUBMITTALS

A. Product data shall be submitted on:

1. Panel
2. Cabinet
3. Bus
4. Construction
5. Dimensions

B. Shop drawing shall be submitted for each and every panel for this project, each and every panel drawing shall clearly indicate the following information:

1. UL Label
2. Each circuit breaker amperage rating, circuit number and position/location in panel
3. Electrical characteristics of panel
4. Mains rating
5. Main device rating
6. Mounting
7. Dimension, width, depth, height
8. Bus material
9. Interrupting capacity of minimum rated breaker
10. Panel type

11. Definitive statement that ends walls are blank
12. Identify that panel include a lockable cover.

1.5 PROJECT RECORD DOCUMENTS

A. Submit record documents to record actual locations of Products; indicate actual branch circuit arrangement.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit Maintenance Data: Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with NECA Standard of Installation.

B. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum ten years' experience.

1.8 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by UL as suitable for purpose specified and indicated.

1.9 FIELD MEASUREMENTS

A. Verify that field measurements are as instructed by manufacturer.

1.10 MAINTENANCE MATERIALS

A. Provide two of each panelboard key.

1.11 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Handle panelboards and enclosures carefully to prevent damage.

B. Store equipment indoors and protect from weather.

C. Deliver tubs and internal assemblies sufficiently in advance of installation period as necessary to prevent delay of work. This time shall be established by a CPM provided by the Contractor and accepted by the supervising authorities.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of design: Square "D"

B. G.E.

C. Eaton

D. Siemens

E. Manufacturers (including accepted substitutions) must provide equipment equal to or superior to the basis of design used on this project.

1. Panels or circuit breakers with an AIC rating less than that shown on the drawings will not be approved.
2. Where basis of design panelboard can accept a certain type, frame, and/or AIC rated breaker, then the accepted substitution manufacturer must also be able to accept all equal breaker type, frame, and/or AIC rating.

2.2 GENERAL

A. Lighting and Appliance Branch Circuit Panelboards: NEMA PB1, circuit breaker type, dead front. UL 67.

B. Panelboard Bus: Copper ratings as indicated. Provide copper ground bus in each panelboard. Provide isolated full size neutral bus where neutral is applicable. Provide non-linear load panelboards as specified on drawings. Non-linear panelboards shall have 200 percent rated neutral busbar.

C. Short Circuit Rating:

1. Minimum integrated short circuit rating: 10,000 amperes rms symmetrical for 208-volt panelboards; 14,000 amperes rms symmetrical for 480-volt panelboards. Bus shall be braced for minimum capacity equal to or greater than the lowest breaker symmetrical interrupting capacity. Minimum short circuit rating shall be increased to meet the following requirements:

   a. Individual CB AIC Rating shown on panel schedules indicate lowest AIC rating allowed for individual circuit breaker in panel.

   b. Circuit breaker types are not shown or called for. The contractor must provide breakers in panel to comply with the required AIC ratings.

2. Short Circuit Rating Label:

   a. Panelboards shall be labeled with a UL short-circuit rating.

D. Enclosure:

1. Enclosures shall be at least 20 inches wide made from galvanized steel. Provide minimum gutter space in accordance with the National Electrical Code. Where feeder cables supplying the mains of a panel are carried through its box to supply other electrical equipment, the box shall be sized to include the additional required wiring space. At least four interior mounting studs with adjustable nuts shall be provided.

2. Enclosures shall be provided with blank ends

3. Where indicated on the drawings, branch circuit panelboards shall be column width type.

4. Regulatory requirements:

   a. NEMA PB 1, Type 1, Type 3R, or Type 4X as indicated on drawings. Use only type 3R or Type 4X for units to be installed outdoors. Use only Type 4X in interior wet locations and designated wash-down areas. For the purposes of this specification, a wash-down area is defined as any area that is directly washed or rinsed with any form of water hose.

5. Cabinet box: 6 inches deep; width: 20 inches minimum. Constructed of code gauge steel, galvanized, or bowdlerized to prevent rust.

E. Cabinet Front: Flush or surface (as indicated on drawings) cabinet front with concealed trim clamps, concealed hinge, and flush lock all keyed alike. Finish in manufacturer's standard baked enamel finish for interior panels. Exterior panels to be painted with rust inhibit primer painted over on all surfaces with epoxy paint.

F. Panels and breakers shall be rated for voltage and class of service to which applied.

G. Spaces:

1. Space provisions or spaces for future breakers shall be located at the bottom of the panel and be fully bussed complete with all necessary mounting hardware less than the breaker.

H. Provide lugs as required for conductors being connected to panelboard lugs, circuit breakers, etc.

2.3 MAINS

A. Provide main lug only (MLO) or main circuit breaker (MCB) as noted on drawings either by riser diagram or by schedule. Where conflict exists, provide MCB.

B. Regardless of what is shown on drawings provide the following minimum requirements.

1. Main circuit breaker on each panel serving building main if required by applicable codes.

2. Main circuit breaker on each panel fed directly from a transformer (unless disconnect with overcurrent devices is installed in feeder between transformer and panel).

C. Provide lugs as required for conductors being connected to panelboard lugs, circuit breakers, etc.

D. Main circuit breaker is not to be mounted as branch breaker or sub feed breaker.

2.4 CIRCUIT BREAKERS

A. General

1. Molded Case Circuit Breakers: NEMA AB 1, plug-in type for 250V or less, bolt-on type for over 250V, thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for lighting circuits. Provide UL Class A ground fault interrupter circuit breakers where scheduled. Do not use tandem circuit breakers.
2. Current Limiting Molded Case Circuit Breakers: NEMA AB 1. Provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size Class RK-5 fuse.

B. Main Breakers:

1. Main breakers shall be individually mounted separate from branch breakers.
2. Covered by a metal plate, except for operating handle.
3. Connection from the load's side to the panel bus shall be bus bar. Insulated wire not permitted.

C. Branch Breakers:

1. Thermal-magnetic molded case, with inverse time-current overload and instantaneous magnetic tripping, unless otherwise shown. Breakers shall be calibrated for 40-degrees C or shall be ambient compensating.
2. Quick-make, quick-break, with tripped indication clearly shown by breaker handle taking a position between ON and OFF.
3. Multi-pole breakers shall have common internal trip. No handle ties between single pole breakers are acceptable for this Project.
4. Multi-wire branch circuit breakers shall have multi-pole breakers as required by the NEC. Handle ties between breaker handles are not acceptable.
5. Single pole 15 and 20 ampere circuit breakers shall be rated for switching duty and shall be labeled as "SWD".
6. AIC rating shall be as called for under "2.2 GENERAL".
7. Breakers feeding heating and air-conditioning equipment shall be rated HACR type breaker.

D. All breakers are to have lugs sized to match conductors called for on drawings.

2.5 SERVICE ENTRANCE EQUIPMENT

A. Panelboards used as service entrance equipment shall be listed and labeled by UL for use as service equipment.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards in accordance with NEMA PB 1.1. Install all panelboards and panelboard enclosures in accordance with the manufacturer's written instructions, NECA's "Standard of

Installation", the applicable requirements of the National Electrical Code, and recognized industry practices.

B. Install panelboards plumb. Install recessed panelboards flush with wall finishes. Provide supports in accordance with Section Hangers and Supports for Electrical Systems.

C. Height: 6 feet to top of panelboard; install panelboards taller than 6 feet with bottom no more than 4 inches above housekeeping curb.

D. Provide filler plates for unused spaces in panelboards.

E. Provide typed circuit directory for each branch circuit panelboard. Mount a typewritten directory showing the actual circuit numbers, type of load and room names on inside of door. Room names shall be actual names or numbers used, not necessarily shown on the drawings. Progress Drawings shall show same arrangements as the Directory. Revise directory to reflect circuiting changes required to balance phase loads.

F. Provide engraved plastic nameplates under the provisions of Section Identification for Electrical Systems.

G. Provide spare conduits out of each recessed panelboard to an accessible location above ceiling. Minimum spare conduits: 4 empty 1 inch. Identify each as SPARE.

H. Proper working clearances shall be maintained at every panelboard location. The working space in front of a panelboard shall be as a minimum, 30 inches wide extending 3 feet, 3.5 feet, or 4 feet (per NEC Article 110-26) out perpendicular to the panelboard.

I. All enclosures shall be firmly anchored to walls and supporting structures (where used) using appropriate hardware. Provide supporting (Unistrut type) channels on walls constructed of gypsum board or where otherwise necessary to provide a mechanically secure and permanent installation. Enclosures shall be installed so that the top is 6'-6" above finished floor. Where the size of the enclosure is such that the top cannot be installed at 6'-6", the top of the enclosure shall be kept as low as possible.

J. Clean the interior of each panelboard before installing conductors. At all times, keep the interior trim and exterior surfaces of the panelboard free of rust and debris. Repaint finishes if necessary.

K. Coordinate all raceways and conductors with their respective panelboards so that all connections and conductors routing present an orderly appearance. Conductors in the panelboards shall be laced and arranged in orderly manner.

L. Collect all keys upon delivery of panelboard. Store keys on one ring to be kept by project superintendent. Forward key ring with keys to Owner upon substantial completion.

3.2 IDENTIFICATION

A. Refer to Section Identification for Electrical Systems for products and content.

B. Provide nameplate shall state panel name, voltage and name of panel that feeds this respective panel, UL short-circuit rating.

3.3 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed.

B. Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

C. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.

D. Feeder conductors shall be checked by accepted means to establish the absence of shorts to ground; insulation value etc. and the result recorded and submitted to the Engineer.

E. All circuits shall be operated to establish a good working order and checked for shorts.

F. All panel directory circuit numbers shall be checked to verify accuracy of the number.

G. Where and when requested by engineer provide:

1. Inspection of equipment by authorized equipment manufacturer technician complete with submittal of statement of findings by technician, and providing any adjustments deemed necessary for a complete operating system.
2. Ground, voltage, and/or load readings complete with submittal on legible form with applicable data.

END OF SECTION

SECTION 26 24 17 - DISTRIBUTION PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the sections included under Division 1, General Requirements, are included as a part of this section as though bound herein.

1.2 SUMMARY

A. Factory-assembled, metal-enclosed panelboard for distribution and control of power from incoming line terminals to outgoing feeder terminals, installed and tested in place.

B. Distribution panelboard shall include all protective devices and equipment as listed on drawings or as included in these specifications, with necessary interconnections and instrumentation.

1.3 REFERENCES AND REGULATORY REQUIREMENTS

A. ANSI/NFPA 70 - National Electrical Code.

B. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.

C. NEMA KS 1 - Enclosed Switches.

D. NEMA PB 2 - Dead front Distribution Switchboards.

E. NEMA PB 2.1 - Proper Handling, Installation, Operation and Maintenance of Dead front Switchboards Rated 600 Volts or Less.

F. UL 67 - Panelboards

G. UL 50 - Enclosures for Electrical Equipment

H. UL 489 Molded Case Circuit Breakers and Circuit Breaker Enclosures

I. Federal Specification W-P-115C-Type I Class I

J. Federal Specification W-C-375 B/GEN-circuit Breakers, Molded Case, Branch Circuit and Service.

1.4 SUBMITTALS

A. Submit Shop Drawings: Indicate:

1. Front and side views of enclosures with overall dimensions shown.
2. Conduit entrance locations and requirements.
3. Nameplate legends.
4. Size and number of bus bars per phase, neutral, and ground.
5. Frame sizes and Interrupting Capacity of each breaker, and total assembly.
6. Horsepower ratings at rated voltage of fused switches and/or breakers.
7. Type of labels and labeling for every device and what it feeds.
8. Nameplate on main panelboard only giving name of project; Architect, Engineer and Contractor.
9. Bus bar size, arrangement and spacing.

B. Submit Product Data: Provide electrical characteristics including voltage, frame size and trip ratings, fault current withstand ratings, and time-current curves of all equipment and components.

C. Submit Test Reports: Indicate results of factory production tests.

D. Submit Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include

instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit Maintenance Data: Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum 10 years' experience.

1.7 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to site.

B. Deliver in sections as required to fit equipment through doors, individually wrapped for protection and mounted on shipping skids.

C. Accept panelboards on site. Inspect for damage.

D. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

E. Handle in accordance with NEMA PB 2.1 and manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Conform to NEMA PB 2 service conditions during and after installation of panelboards.

1.10 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated and comply with instructions by manufacturer.

1.11 MAINTENANCE MATERIALS

A. Provide two of each key (where applicable).

B. Provide two fuse pullers (where applicable).

PART 2 - PRODUCTS

2.1 GENERAL

A. Panelboards with circuit breaker, or fusible switch, branch protective devices shall comply with NEMA PB2 as a minimum requirement. Panelboards shall be NEMA I and shall meet Underwriter's Laboratories enclosure requirements for service conditions.

B. Each cubicle shall have UL Label affixed, unless special construction prohibits, and no labeling or listing is available.

C. See drawings for acceptable manufacturers. Basis of design is Square D.

D. Short-Circuit Rating Label

1. Minimum integrated short circuit rating: 10,000 amperes rms symmetrical for 208 volts; 14,000 amperes rms symmetrical for 480 volts. Bus shall be braced for minimum capacity equal to or greater than the lowest breaker symmetrical interrupting capacity. Minimum short circuit rating shall be increased to meet the following requirements:

2. Individual CB AIC Rating shown on panel schedules indicate lowest AIC rating allowed for individual circuit breaker in panel.

3. Circuit breaker types are not shown or called for. The contractor must provide breakers in panel or feeder breakers to comply with the required AIC ratings.

E. Provide lugs on bus, distribution panelboard and circuit breakers as required to match conductors being connected/terminated.

2.2 MANUFACTURERS

A. Basis of Design: Square D

B. G.E.

C. Eaton

D. Siemens.

2.3 DISTRIBUTION PANELBOARDS

A. Description: NEMA PB 2 with electrical ratings and configurations as indicated.

B. Main Section Devices: Panel mounted.

C. Distribution Section Devices: Panel mounted.

D. Bus Material: Copper with tin plating standard size.

E. Bus Connections: Bolted, accessible from front for maintenance.

F. Ground Bus: Extend length of board.

G. Molded Case Circuit Breakers: NEMA AB 1, integral thermal and instantaneous magnetic trip in each pole. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.

H. Solid-state Molded Case Circuit Breakers: NEMA AB 1, provide with electronic sensing, timing, and tripping circuits for adjustable current settings; ground fault trip; instantaneous trip; and adjustable short time trip. Provide ground fault sensing integral with circuit breaker.

I. Line and Load Terminations: Accessible from the front of the switchboard only, suitable for the conductor materials and sizes indicated.

J. Ground Fault Sensor: (Where called for on drawings). Zero sequence or Ground return type.

K. Ground Fault Relay: (Where called for on drawings). Adjustable ground fault sensitivity from 200 to 1200 amperes, time delay adjustable from 0 to 15 seconds. Provide monitor panel with lamp to indicate relay operation, TEST and RESET control switches.

L. Future Provisions: Fully equip spaces for future devices with bussing and bus connections, suitably insulated and braced for short circuit currents. Provide continuous current rating as indicated.

M. Enclosure: Type 1 - General Purpose for interior locations and 2 - Raintight for exterior locations.

1. Align sections at front and rear.

2. Finish:

a. Interior: Manufacturer's standard light gray enamel over external surfaces. Coat internal surfaces with minimum one coat corrosion-resisting paint, or plate with cadmium or zinc.

b. Exterior: Coat interior and exterior of enclosure with rust inhibiting primer and paint over with epoxy paint

3. Enclosures shall be at least 20 inches wide made from galvanized steel. Provide minimum gutter space in accordance with the National Electrical Code. Where feeder cables supplying the mains of a panel are carried through its box to supply other electrical equipment, the box shall be sized to include the additional required wiring space. At least four interior mounting studs with adjustable nuts shall be provided.

4. Enclosures shall be provided with blank ends.
5. Where indicated on the drawings, branch circuit panelboards shall be column width type.

N. Breakers
1. All breakers are to have lugs sized to match conductors called for on drawings.
2. Main circuit breaker is not to be mounted as branch breaker or sub-feed breaker.
3. Breakers feeding heating and air conditioning equipment shall be rated HACR type breaker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surface is suitable for distribution panelboard installation.

3.2 INSTALLATION

A. Install distribution panelboard in locations shown on Drawings, in accordance with manufacturer's written instructions and NEMA PB 2.1.

B. Tighten accessible bus connections and mechanical fasteners after placing switchboard.

C. Install fuses in each switch (where applicable).

3.3 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of section Tests and Performance Verification of Electrical Systems.

B. Inspect completed installation for physical damage, proper alignment, anchorage, and grounding.

C. Measure insulation resistance of each bus section phase to phase and phase to ground for one minute each, at test voltage of 1000 volts; minimum acceptable value for insulation resistance is 2 megohm.

D. Check tightness of accessible bolted bus joints using calibrated torque wrench.

3.4 ADJUSTING

A. Adjust all operating mechanisms for free mechanical movement.

B. Tighten bolted bus connections in accordance with manufacturer's instructions.

3.5 CLEANING

A. Touch up scratched or marred surfaces to match original finish.

3.6 LABELING

A. Provide nameplate/label at each protective device.

B. Nameplate shall state panel name, voltage and name of panel that feeds this respective panel.

END OF SECTION

SECTION 26 24 19 - MOTOR CONTROL CENTER

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Base Bid:

1. Electrical Contractor shall provide:

a. Complete motor control center, including all motor starters, switches and overcurrent protection and control devices as shown on the drawings and as required to complete all power wiring to motor loads and miscellaneous mounting hardware.

1.2 RELATED WORK

A. Specified Elsewhere:

1. Basic Electrical Materials and Methods
2. Raceways
3. Wire and Cables
4. Overcurrent Protective Device
5. Motor Starters

1.3 SUBMITTALS

A. In accordance with Division 1.

1. Shop Drawings: Complete motor control center.
2. Product Data: All components.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Control centers shall be metal enclosed, dead front, rigid free standing, low voltage, multi-unit type. Control centers shall be furnished NEMA Class 1, Type B construction. They shall be for 480-volt, 3 phase, 60 hertz, power service, as indicated and shall consist of the required vertical sections. Vertical sections shall be 90 inches high, assembled into a group having a common horizontal power bus and forming an enclosure to which additional sections may readily be added. The depth shall be 21 inches.

B. Side plates of each vertical section shall be sheet steel with full height flanges drilled to provide interchangeable mounting of standard units. Sections shall have removable plates on the top, back, upper front, lower front and end. Standard sections shall include a vertical wireway. Unused portions of the section shall be covered by blank doors. Sections shall be arranged for front mounting only. Where “spaces” are indicated on the drawings, provisions shall be complete, except for the starters.

C. Finish shall be applied to both interior and exterior surfaces in the manufacturer’s standard type finish.

D. The main horizontal bus shall be silver plated copper, rated as shown on the drawings. This main bus shall run continuously the full width. Both top and bottom compartments shall include a wireway which lines up with the wireways in the vertical sections. Space shall be provided at the top and bottom for conduit entrance and wiring. Each vertical section shall have bus bars running full height of the section and shall be connected to the horizontal bus. There shall be no splices in the vertical bus. All bus work shall be properly braced and supported to withstand short circuits of 50,000 RMS amperes. Provide ground bus.

E. Sections shall be divided into units, each containing a combination magnetic starter, circuit breaker or other control assembly. Starters shall be combination starters with MCP overcurrent device and disconnect. Starters shall be FVNR or two speed as shown on the drawings. The starter units shall have external manual reset. No starter shall be smaller than NEMA size 1.

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SECTION 26 27 13 - UTILITY SERVICE ENTRANCE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the sections included under Division 1, General Requirements, are included as a part of this section as though bound herein.

1.2 SUMMARY

A. Furnish, install, or otherwise provide all equipment, and/or coordination, and supervision necessary to furnish a new electrical service to the facility. This shall include all necessary temporary services and connections.

B. Assessments by the utility for permanent electrical service shall be paid by the Owner.

C. Assessments for temporary electrical services shall be paid by the Contractor who shall contact the utility company prior to bid for inclusion of these charges.

1.3 SECTION INCLUDES

A. Arrangement with Utility Company for permanent electric service, including payment of Utility Company charges for service.

B. Underground service entrance.

C. Metering equipment.

D. Temporary Service.

1.4 COORDINATION

A. Fully coordinate with the local Utility Company to provide electrical service to the facility. Provide underground raceways, trenching, backfilling, etc. where required.

1.5 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

1.6 SUBMITTALS

A. Submit Utility Company prepared drawings.

B. Submit product data on:

1. Surge protection.
2. Lightning arresters.
3. Meter/C.T. cabinet if applicable.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with Utility Company written requirements.

B. Arrange for all inspections required by the Utility Company and obtain written approval to proceed.

1.8 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

C. The rules and regulations of the local Utility Company shall govern all service and metering requirements.

1.9 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated.

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PART 2 - PRODUCTS

2.1 GENERAL

A. Refer to appropriate sections contained within these specifications for standards concerning materials used.

2.2 UTILITY METERS

A. Meters will be furnished by Utility Company.

2.3 UTILITY METER BASE

A. Meter base will be furnished by the Utility Company installed by the contractor.

2.4 TRANSFORMER PAD

A. Description: Transformer pad will be furnished by the Utility Company installed by the contractor.

2.5 LIGHTNING ARRESTER

A. Unit shall be UL Listed and in accordance with Section Surge Protection Devices.

2.6 SURGE SUPPRESSION

A. Suppressors shall be in accordance with Section Surge Protection Devices.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that service equipment is ready to be connected and energized.

3.2 PREPARATION

A. Make arrangements with Utility Company to obtain permanent electric service to the Project.

B. Coordinate location of Utility Company's facilities to ensure proper access is available.

C. This Contractor shall notify the Utility Company in writing, with two copies to the Engineer, no later than 10 days after signing contracts as to when this Contractor anticipates the building power service will be required.

D. Contact Power Company within 15 days of award of contract. Provide power company copies of contract documents needed and/or required by Power Company within 30 days of contract Notice to Proceed.

3.3 TEMPORARY SERVICES

A. Throughout the period of construction, provide all temporary services and connections necessary to maintain without interruption all electrical services in support of construction and Owner activities. The only exception to this requirement shall be scheduled interruptions made with the prior acceptance of the Owner.

B. The facilities and equipment required to provide all electrical power for construction, lighting and balancing and testing consumed prior to final acceptance of the project shall be provided under this section of the specifications. All wiring, outlets and other work required to provide this power at the site and within the building for all trades shall be arranged for, furnished, and installed under this section of the specifications including any fee, charge or cost due the utility company for temporary power installation or hook-ups.

C. Facilities shall be furnished in a neat and safe manner in compliance with governing codes, good working practices and OSHA regulations.

3.4 CONTRACTOR RESPONSIBILITIES

A. The Contractor shall furnish all labor, materials, etc., necessary for a complete accepted electrical service as required for this project, including inspection and acceptance by the Utility and local Inspection Departments (if any) and inform the Engineer prior to energizing power lines within the structure.

3.5 UNDERGROUND ELECTRICAL SERVICE

A. Furnish and install underground service from power company pad mounted transformer to main service equipment. Seal conduit with duct-seal where entering building.

B. The underground service shall comply with all the requirements of the NEC, local Utility Company and State enforcing authority.

C. The concrete pad shall be furnished by the Utility Company and installed by this Contractor.

D. Install Utility Company provided buried primary conduits from the pad to point of Utility Company service as shown on drawings or as required by Utility Company.

E. Install service entrance conduits from Utility Company's pad-mounted transformer to building service entrance equipment. Connect service lateral conductors to service entrance conductors.

3.6 METERING

A. Meters and metering equipment shall be furnished by the Utility Company and installed under this Division of the specifications.

3.7 LIGHTNING ARRESTERS AND SURGE SUPPRESSION

A. A lightning arrestor shall be provided on the line side of each main service from transformer. A surge suppression device shall be provided on the load side. Units shall match service voltage.

B. Installation including mounting connections, grounding and length of leads shall conform to manufacturers' recommendations.

C. Surge suppression unit shall be installed in accordance with Section Surge Protection Devices.

3.8 PAD

A. Install Utility Company precast concrete pad as directed/required by Utility Company.

END OF SECTION

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SECTION 26 27 16 - CABINETS AND ENCLOSURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the sections included under Division 1, General Requirements, are included as a part of this section as though bound herein.

1.2 SUMMARY

A. Provide and install all equipment, labor, material, accessories, and mounting hardware for a complete operating system for the following:

1. Hinged cover enclosures.
2. Cabinets.

B. Cabinets and enclosures are to include:

1. Terminal blocks,
2. Mounting panel,
3. Ground bus/bar, and
4. All accessories as required for a complete operating system.

C. Provide and install cabinets and enclosures, as specified herein, for all systems specified in all sections of the Division 26, Division 27 and Division 28 sections when included in specifications.

1.3 REFERENCES AND REGULATORY REQUIREMENTS

A. Conform to the requirements of the following:

1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
2. NEMA ICS 4 - Terminal Blocks for Industrial Control Equipment and Systems.
3. ANSI/NFPA 70 - National Electrical Code.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.4 SUBMITTALS

A. Submit Product Data: Provide manufacturer's standard data for enclosures and cabinets.

B. Submit Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

C. Submit actual shop drawings on all cabinets and enclosures showing:

1. Covers.
2. Dimensions - inside and out.
3. Gauge of metal.
4. Manufacturer.
5. Terminal mounting plate, construction, etc.
6. Ground bus/bar.

1.5 EXTRA MATERIALS

A. Provide two of each cabinet key.

PART 2 - PRODUCTS

2.1 GENERAL

A. Unless specifically called for otherwise on contract drawings, provide "CABINETS" as specified herein for terminal cabinets mounted indoor. Similarly, provide "HINGED COVER ENCLOSURES" as specified herein for terminal cabinets mounted outdoors or in locations other than NEMA 1 locations. Also, provide "HINGED COVER ENCLOSURES" for locations where size required is not available in "CABINET" construction, or if specifically specified as "enclosure" on contract documents.

B. Size.

1. Dimensions of cabinets and enclosures shall meet the dimensions shown on drawings, dimensions required by NEC, or dimensions sized as required to facilitate all equipment/connections involved installation, whichever is largest.
2. Coordinate with Division 27 and 28 sections and Section Surge Protection Devices of these specifications to assure that size of equipment cabinet or enclosure will house and facilitate proper installation and access to equipment, to be installed/mounted in cabinet or enclosure.

C. Provide metal barriers to separate compartments containing control wiring operating at less than 50 volts from power wiring.

D. Provide accessory feet and/or mounting brackets for free-standing equipment.

E. Cabinets and enclosures installed outdoors shall be fully weatherproof and watertight.

2.2 HINGED COVER ENCLOSURES

A. Construction:

1. Interior Locations: NEMA Type 1 (unless otherwise noted), steel.
2. Exterior Locations: NEMA Type 4X.
    a. Stainless steel.

B. Covers: Continuous hinge.

C. Enclosure Finish:

1. NEMA 1: manufacturer's standard metallic gray enamel over phosphatized surfaces.
2. NEMA 4X:
    a. Stainless steel.

D. Lock/handle.

1. Provide/install key lock handle on all enclosures mounted in rooms/areas/spaces that are not electrical rooms or mechanical rooms. Enclosures installed in electrical rooms need not be and are not required to be lockable.

E. Interior mounting plate.

1. Each enclosure is to have interior mounting plate/panel for mounting terminal blocks and electrical components.
2. Plate/panel is to be metal.

F. Ground bus/bar.

1. Each enclosure housing surge suppression equipment or other equipment shall have "local" ground bar/bus installed. See specification for "Local Ground Bus/Bar" included within this section.

G. Manufacturers:

1. Hoffman

2. Schaeffer

2.3 CABINETS

A. Construction: Code gauge steel with removable end-walls.

B. Finish:

1. Boxes: galvanized steel.
2. Fronts: gray baked enamel.

C. Fronts:

1. Electrical or mechanical room locations: screw cover with flush handle or as noted below.
2. Other locations: mono-flat with concealed trim clamps, concealed hinges, and flush lock lockable handle.
3. Flush or surface type as shown or called for on contract documents.

D. Interior mounting plate.

1. Each enclosure is to have interior mounting plate/panel for mounting terminal blocks and electrical components.
2. Panel/plate may be constructed of wood if painted with fire retardant paint of a flame spread rating of Class A, if it meets all applicable codes, and it is acceptable to the authority having jurisdiction, otherwise plate to be metal.

E. Ground bus/bar.

1. Each cabinet housing surge suppression equipment or other equipment shall have "local" ground bar/bus installed. See specification for "Local Ground Bus/Bar" included within this section.

F. Manufacturer:

1. Sq. "D" Class 6650 Series.
2. Hoffman.

2.4 TERMINAL BLOCKS

A. Terminal Blocks: ANSI/NEMA ICS 4.

B. Power Terminals: Unit construction type with closed back and tubular pressure screw connectors, rated 600 volts.

C. Signal and Control Terminals: Modular construction type, suitable for channel mounting, with tubular pressure screw connectors, rated 300 volts.

D. Provide ground bus terminal block, with each connector bonded to enclosure.

2.5 LOCAL GROUND BUS/BAR

A. Size to handle #6 through #14 AWG copper ground wire.

B. Length as required for circuits.

C. Manufacturer:

1. Sq. "D" #PK***GTA Series.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive Work.

3.2 INSTALLATION

A. Install Products in accordance with manufacturer's instructions.

B. Install enclosures and cabinets plumb. Anchor securely to wall and structural supports at each corner.

C. Install cabinet fronts plumb.

D. Install per NEC and as required for proper clearance. Coordinate with panels.

E. Provide and install terminal cabinets as shown on drawings or as required by the National Electrical Code (NEC).

F. Provide and install terminal cabinets wherever required for a complete and operating distribution system whether shown on drawings or not.

G. Install local ground bus/bar in each terminal cabinet/enclosure that houses surge suppression equipment or other equipment and bond to cabinet enclosure via mounting screws or #6 AWG copper ground wire.

H. Ground local ground bus to "SYSTEMS" ground bus/bar with minimum #6 AWG copper ground wire. Increase size if so, required on drawings.

I. Install enclosures.

END OF SECTION

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the sections included under Division 1, General Requirements, are included as a part of this section as though bound herein.

1.2 SUMMARY

A. Provide and install all equipment, labor, material, accessories, and mounting hardware for a complete operating system for the following:

1. Wall switches.
2. Wall dimmers.
3. Receptacles.
4. Device plates and decorative box covers.

1.3 REFERENCES

A. NEMA WD 1 - General Purpose Wiring Devices.

B. NEMA WD 5 - Wiring Devices, Special Purpose

C. NEMA WD 6 - Wiring Device Configurations.

1.4 SUBMITTALS

A. Submit Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

1. Submit product data on all types of wiring devices including plates and engraving.

B. Submit Manufacturer's Instructions:

1. Indicate application conditions and limitations of use stipulated by product testing agency specified under regulatory requirements.
2. Include instructions for storage, handling, protection, examination, preparation, operation, and installation of product.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years' experience.

1.6 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.7 EXTRA MATERIALS

A. Provide a minimum of two screw drivers of each type of tamper proof screw used on project.

B. Turn over to owner. Submit receipt in O&M manual.

PART 2 - PRODUCTS

2.1 GENERAL

A. All devices shall be Specification Grade as minimum.

B. General purpose wiring devices shall meet NEMA standard WD-1, Wiring Devices, General Purpose. Special purpose devices shall conform to the requirements of NEMA standard WD-5, Wiring Devices, Special Purpose.

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C. All wiring devices shall bear UL labels.

D. All devices of one type (i.e., all snap switches, all duplex receptacles, etc.) shall be by the same Manufacturer. "Hazardous Location" and special purpose devices as may not be available from the same manufacturer shall constitute the only exception to this requirement of single source.

E. Corrosion resistant devices shall be as specified for normal usages and fabricated of yellow color melamine plastic. Where "Weatherproof" type is indicated for exterior or wet locations, provide matching self-closing cover, with gasketed seals at plate/wall junctions and for cover.

F. Provide factory packaged wiring devices having high impact strength molded plastic bodies.

G. Except where specifically required in these specifications use of interchangeable type or combination switch-receptacle-pilot devices is not acceptable and shall be removed.

2.2 WALL SWITCHES

A. Manufacturers:

1. Legrand
2. Leviton
3. Hubbell

B. General:

1. Snap switches for general use shall be maintained contact types, and shall be single-pole, double-pole, three-way, or four-way as required for the specific switching arrangements shown on the drawings. They shall be quiet tumbler operation types, having silver alloy contacts, and meeting all NEMA performance standards. Color to match plates unless specifically noted otherwise in specifications and/or on drawings.
2. Switches shall be toggle or key-operated types, as indicated on the drawings. All key-operated switches shall be keyed alike.
3. Where switches are denoted as having pilot lights, pilot lights shall glow when the switches are "ON". Provide pilot light switch with lamp and miniature step-down transformer. The pilot light shall have a red lens, and the lamp shall be long-life type.
4. Jewels for use with switches controlling motors shall be green, and jewels for other purposes shall be amber. All units shall be front re-lamp able.
5. Snap switches installed in hazardous locations shall be UL listed for the type of location (class and division).
6. Voltage and ampere rating of switches shall be marked on switch and shall conform to voltage of system to which applied.

C. Description: NEMA WD 1, heavy-duty, AC only general-use snap switch.

D. Voltage Rating: 120-277 volts, AC.

E. Current Rating: 20 amperes minimum.

F. Ratings: Match branch circuit and load characteristics.

2.3 WALL DIMMERS

A. Manufacturers:

1. Legrand
2. Leviton
3. Hubbell

B. Description: NEMA WD 1, semiconductor dimmer for incandescent lamps, type as indicated on Drawings.

C. Device Body: Plastic with rotary knob or linear slide as called for on drawings.

D. Voltage: 120 volts or as required to match application.

E. Power Rating: Match load shown on Drawings; 600 Watts minimum.

F. Accessory Wall Switch: Match dimmer appearance.

1. Same manufacturer and style as dimmer switch.

2.4 RECEPTACLES

A. General:

1. All receptacles shall be of standard NEMA configuration, as indicated on the drawings, and shall comply with the respective ANSI C73 series standard for the NEMA configuration. Color to match plates unless specifically noted otherwise in specifications and/or on drawings.

2. Duplex receptacles shall have integral UL listed self-grounding clips. Similar, single receptacles shall be provided for plug-in connections of Industrial Fluorescent light fixtures on the same switching circuit. Receptacle faces to be impact resistant nylon.

3. Weatherproof duplex receptacles shall be provided in all exterior locations and shall be Ground Fault Circuit Interrupting (GFCI) types, with weatherproof cover plates allowing use of receptacle with cover in closed position.

4. Special purpose receptacles for specific equipment shall be grounding types, having the number of poles, voltage and ampere ratings, and NEMA configurations required by the equipment. For each special purpose receptacle, provide an identical mating plug equipped with cord grip, secured to cord.

5. Duplex receptacles shall have back and side wired screw pressure terminals.

B. Description: NEMA WD 1; heavy-duty general use receptacle.

C. Configuration: NEMA WD 6; heavy-duty, general use type as specified and indicated.

D. Convenience Receptacle: Type 5-20.

E. GFCI Receptacle: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.

F. Manufacturers:

1. Legrand

2. Leviton

3. Hubbell

2.5 COVER PLATES

A. All wiring devices shall be provided with standard size one-piece cover plates of suitable configuration for the number and type of devices to be covered.

B. Metallic cover plates shall be used in interior spaces, except as noted below, and shall be fabricated of corrosion-resistant #302 stainless steel, having a nominal thickness of .04 inch, and a brushed finish. Screws securing the plates shall have flush (when installed) heads with finish to match plates. Metallic cover plates shall meet all requirements of the National Electrical Code and Federal Specifications.

C. Cover plates for switches located in corrosive atmospheres (where vapor-proof is not indicated) shall be equal to Hubbell #17CM81/#17CM82/#17CM83/#17CM84 one piece neoprene with matching press switch.

D. Cover plates for exterior receptacles shall be gasketed covers with hinge allowing plug and cord to be plugged in and activated with cover closed.

E. Cover plate engraving, where required, shall be accomplished by cover plate manufacturer in accordance with instructions given on the drawings. Metallic plates in ivory, beige, gray, and white shall be engraved with black fill. Red, brown, and black plates shall be engraved with white fill.

2.6 COLOR

A. Devices connected to normal power and located in finished interior spaces shall be of color selected by Architect from the following list of standard colors: ivory, beige, gray, white, brown, and black.

B. Cover plates for devices connected to normal power and located in finished interior spaces shall be of color selected by Architect from the above list of standard colors or #302 SS.

C. All devices and cover plates in paneled walls shall have finish to match paneling.

D. Receptacles and switches connected to the emergency branch of the power system shall be 'RED'. Cover plates for such devices shall be stainless steel and engraved with "STANDBY POWER".

E. Receptacles connected to the computer power distribution branch shall be 'GREY' in color, with trim plate to match other normal power receptacles.

F. Contractor shall modify any given catalog numbers as required to procure devices and plates of the proper color.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify conditions under provisions of Division 1 - General Requirements and any other applicable supplemental requirements/conditions.

B. Verify outlet boxes are installed at proper height.

C. Verify wall openings are neatly cut and will be completely covered by wall plates.

D. Verify floor boxes are adjusted properly.

E. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean debris from outlet boxes.

3.3 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install devices plumb and level.

C. Install switches with OFF position down.

D. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

E. Do not share neutral conductor on load side of dimmers.

F. Install receptacles with grounding pole on bottom.

G. Install decorative plates on switch, receptacle, and blank outlets in finished areas.

H. Electrical boxes shall be cleaned and completely free of any debris, dust, etc. prior to the installation of wiring devices.

I. Where 2 or more switches or receptacles are to be installed adjacent to one another, provide a multi-gang box and combination multi-gang coverplate. Provide proper NEC barriers in boxes which serve devices for both the Normal and Emergency Systems.

J. Provide device cover plates for every device installed. Cover plates shall be installed so that they appear straight with no gaps between plate edges and the wall. Maintain vertical and horizontal to within 1/16 of an inch.

K. In finished areas, provide same type of plate for all surface mounted devices as for recessed mounted devices.

L. In any room, where new and existing construction is present, all receptacles, switches, and coverplates which are existing to remain shall be changed, as required to match new work.

M. Wiring devices shall not be installed in exposed masonry until cleaning of masonry with acids has been completed.

N. All receptacles and switches shall be grounded by means of a ground wire from device ground screw to outlet box screw and branch circuit ground conductor. Strap alone will not constitute an acceptable ground.

O. All wiring devices, relays, contactors, pushbuttons, selector switches, pilot lights, etc. shall be installed in approved enclosures rated for the appropriate NEMA classified environment.

P. All devices shall be installed so that only one wire is connected to each terminal.

Q. Once construction is substantially completed, replace all damaged, burned, or scorched wiring devices.

R. Receptacles shown to be floor mounted shall be installed in floor boxes (with cover-plates) which are approved for this use.

S. Connect wiring devices by wrapping conductor around screw terminal.

T. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

U. Install protective rings and split nozzle on active flush cover service fittings.

V. Install local room area wall switches at door locations on the lock side of the door, approximately four inches from the jamb. Where locations shown on the drawings are in question, provide written request for information to A/E prior to rough-in.

3.4 NEUTRAL CONDUCTOR CONNECTIONS

A. At each receptacle "in" and "out" phase and neutral conductors shall have an additional conductor for connection to device. The practice of "looping" conductors through receptacle boxes shall not be acceptable.

3.5 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations of outlet boxes provided under other sections of these specs to obtain mounting heights specified and indicated on Drawings.

3.6 FIELD QUALITY CONTROL

A. Inspect each wiring device for defects.

B. Operate each wall switch with circuit energized and verify proper operation.

C. Verify that each receptacle device is energized.

D. Test each receptacle device for proper polarity.

E. Test each GFCI receptacle device for proper operation.

3.7 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

END OF SECTION

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SECTION 26 28 19 - ENCLOSED DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the sections included under Division 1, General Requirements, are included as a part of this section as though bound herein.

1.2 SUMMARY

A. Provide all labor, materials, and equipment necessary to properly install switches as shown on the drawings and as required by codes.

B. Coordinate with Division 23 Contractor and specifications as to who is to provide disconnect switches for mechanical equipment. Provide all disconnect switches not being provided by Division 23 Contractor.

1.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver switches in factory wrapped packaging to the site. Handle switches carefully to prevent damage. Store in a clean, dry space protected from dirt, water, and physical damage. Do not install damaged switches.

1.4 QUALITY ASSURANCE

A. The manufacturer of switches shall be the same as that of the panelboards.

1.5 SUBMITTALS

A. Submit catalog cut sheet on each type of disconnect switch to be used on this project.

PART 2 - PRODUCTS

2.1 CONSTRUCTION

A. Switches shall be heavy duty types with visible, quick-make, quick-break blades.

B. Units for 2-speed motors shall be 6-pole in a single enclosure. Use of two 3-pole units will not be acceptable.

C. Provide ground bus and where required, a solid neutral bus.

D. Switches shall be fusible or non-fusible as denoted on the drawings or as required by the equipment served from the switch. Fusible switches shall have rejection type fuse holders.

E. Terminal lugs shall be rated for 75 degrees Centigrade.

F. Enclosures, unless otherwise noted, shall be NEMA 1 for indoor locations and NEMA 4SS for outdoor locations as a minimum. Provide NEMA 4SS at any locations where a NEMA 3R is noted on the drawings.

G. The enclosure shall be interlocked with the switch handle such that the enclosure door or cover cannot be opened with the switch in the "ON" position. The switch handle shall be capable of being padlocked in the "OFF" position but not in the "ON" position.

H. Finish for NEMA I units shall be standard baked gray enamel finish over a rust inhibiting phosphate primer.

2.2 DISCONNECT SWITCHES

A. Disconnect switches installed between any variable speed drive type of unit (VFD, AFD, USD, etc.) and its respective motor(s), shall have auxiliary break before break (open) interlock control contact.

B. Disconnect switches installed to disconnect HVAC equipment are to be fusible type with fuses as recommended by HVAC manufacturer.

2.3 RATING

A. The size, number of poles, and fusing for each switch shall be as denoted on the drawings. As a minimum, no less than one pole for each ungrounded conductor shall be provided. Switches shall be rated 250 VAC or 600 VAC as required by the circuit to which it is connected.

B. Switches serving motors with more than one set of windings shall have the number of poles necessary to disconnect all conductors to all windings in a single switch. Switches serving motor loads shall be horsepower rated of sufficient size to handle the load.

2.4 SERVICE ENTRANCE EQUIPMENT

A. Switches used as service entrance equipment shall be listed and labeled by UL for use as service equipment.

2.5 ENCLOSED CIRCUIT BREAKERS

A. Molded Case Circuit Breakers: NEMA AB1, plug-on type for 250V or less, bolt-on type for over 250V, thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for lighting circuits. Breakers shall be HID rated. Provide UL Class A ground fault interrupter circuit breakers where scheduled. Do not use tandem circuit breakers.

B. Thermal-magnetic, molded case, with inverse time-current overload and instantaneous magnetic tripping, unless otherwise shown. Breakers shall be calibrated for 40 degrees C or shall be ambient compensating.

2.6 MANUFACTURERS:

A. Square D (Basis of Design

B. G.E.

C. Eaton

D. Siemens

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all switches in accordance with the manufacturer's written instructions, NECA's "Standard of Installation", the applicable requirements of the National Electrical Code, and recognized industry practice.

B. All switches shall be firmly anchored to walls and supporting structures (where used) using appropriate installation. Switches shall be installed with the turning axis of their handles approximately 5'-0" above finished floor unless otherwise indicated. Provide rigid steel (galvanized for exterior use) mounting stands, brackets, plates, hardware, and accessories for a complete installation.

C. Switches shall be mounted in accessible locations chosen where the passageway to the switch is not likely to become obstructed. Where a switch serves as the disconnecting means for a load, the switch shall be located as close as practical to the load with the switch handle within sight of the load.

D. Provide and install lugs on disconnect switch as required to accept conductors called for on drawings.

E. Disconnect switches shall not be mounted on equipment, unless specifically noted or required and meet all applicable codes, etc. If switches are noted or required to be mounted on equipment, they shall have vibrator clips on fuses and be connected to conduit system with liquid tight flexible conduit.

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F. Coordinate all requirements for controls between variable speed drive units and its respective motor with drive specification, manufacturer, provider, and installer. Provide auxiliary contacts, relays, etc. as required.

END OF SECTION

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SECTION 26 29 13 - MOTOR CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the sections included under Division 1, General Requirements, are included as a part of this section as though bound herein.

1.2 SUMMARY

A. This section covers factory-assembled, metal-enclosed motor control units for distribution and control of power from incoming line terminals to outgoing feeder terminals, installed and tested in place.

B. Motor control units shall include all protective devices and equipment as listed on drawings or as included in these specifications, with necessary interconnections, instrumentation, and control wiring.

1.3 FURNISHING OF EQUIPMENT

A. Unless specifically noted otherwise, automatic motor starters for all equipment requiring them shall be furnished under the section or division where equipment is specified and installed under this Section of the specifications.

B. Provide all labor, materials, and equipment necessary to properly install all motor starters. Provide motor starters for all new motors to be wired, where starters are not elsewhere specified under work of that Division which provides the motored equipment.

C. Unless specifically noted, manual motor starters shall be furnished and installed under this section of the specifications.

D. Disconnect switches for 120V fractional HP exhaust fans to be provided by Division 23 contractor at exhaust fan. Any other required disconnect switch to be provided and installed by Division 26 contractor.

1.4 CONTROL ITEMS

A. Unless specifically noted, all control, alarm and interlock wiring required for proper operation of equipment furnished by any other Contractor and the required raceways shall be furnished and installed under the Division where the equipment is specified.

B. Where required by electrical drawings, Division 23 specifications, and/or mechanical drawings this contractor shall connect power feeder to mechanical equipment via control devices furnished by Division 23 contractor. (i.e., starters, line voltage, T-stats, line voltage switch, control relays, etc.).

C. Provide and install power circuits to all control devices requiring them (i.e., 120V dampers, control panels, control devices, etc.) whether shown on drawings or not. Coordinate requirements of all Divisions and/or Sections of these Specifications prior to bid.

1.5 SUBMITTALS

A. Shop Drawings and Product Data:

1. Shop Drawings, Individually mounted AC Manual Starter

a. Shop Drawings shall clearly indicate:

i. Frame sizes and Interrupting Capacity of manual starter and/or disconnect unit.

ii. Horsepower rating at rated voltage of manual starter and/or disconnect unit.

iii. Electrical ratings.

iv. Single line diagram for power and control connections with numbered terminals and all required accessories.

v. All required accessories.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design:
   1. Square D

B. Accepted Substitutions:
   1. General Electric
   2. Siemens
   3. Eaton

2.2 GENERAL

A. Motor starters shall be manual, magnetic, or combination type as denoted on the drawings.

B. Pilot lights shall have long-life lamps rated 7500 hours minimum.

C. Enclosures shall be NEMA 1 for indoor locations and NEMA 4SS for outdoor or wet locations except where indicated as NEMA-4X.

D. Multi-speed or stop type controllers shall have thermal overload relays in each ungrounded conductor for each speed or step.

E. Where multi-speed motors are scheduled on the drawings, the motor controls shall be compatible with the type of motor and have adjustable time deceleration for transition from high to low speeds.

2.3 INDIVIDUALLY MOUNTED AC MANUAL STARTERS

A. Where manual motor starter switch is called for on drawings, it shall be a combination across-the- line manual type starter with overloads and disconnect rated in accordance with NEMA Standards, sizes, and horsepower rating. Final rating of overloads shall be field set and recorded. Unit shall be mounted on NEMA 1 enclosures, unless otherwise noted.

B. Manual motor starter switch shall include green "run" pilot light and shall be surface or flush mounted as noted on drawings.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine area to receive motor-control units to assure adequate clearance for motor control unit installation.

3.2 INSTALLATION

A. Install motor control units in accordance with manufacturer's written instructions, and NEC.

B. All starters and their respective enclosures shall be firmly anchored to walls and supporting structures (where used) using appropriate hardware. Provide supporting (Unistrut type) channels on walls constructed of gypsum board or where otherwise necessary to provide a mechanically secure and permanent installation. Starters shall be installed with their turning axis of their handles approximately 5'-0" above finished floor. Provide rigid steel (galvanized for exterior use) mounting stands, brackets, plates, hardware, and accessories for a complete installation.

C. Starters shall be mounted where shown on the drawings. Where the starter also provides the code- required disconnecting means for a load, the starter shall be located within sight of the load and as close as feasible.

D. Provide fusing for all fusible switches.

E. Provide properly sized heater elements for every starter overload relay. The element shall be sized using the nameplate full load running current of the actual equipment supplied to the job.

F. Provide a heater element selection chart on the inside of each starter door.

G. Provide spare pilot light lamps to the Owner. Provide 2 of each type and size load.

H. Provide nameplate for each control units.

3.3 ADJUSTMENT AND CLEANING

A. Adjust operating mechanisms for free mechanical movement.

END OF SECTION

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SECTION 26 36 23 - MANUAL TRANSFER SWITCH

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the sections included under Division 1, General Requirements, are included as a part of this section as though bound herein.

1.2 SUMMARY

A. The transfer switch shall be provided as described herein and shown on Drawings. The transfer switch shall be capable of switching all classes of load and shall be rated for continuous duty when installed in a nonventilated enclosure.

B. Transfer switch shall be a true 4-pole type. The normal and emergency full load current and voltage ratings at 60 cycles shall be as called for on Drawings.

1.3 REFERENCES

A. IEEE Institute of Electrical and Electronics Engineers

B. NEC National Electrical Code

C. UL Underwriters Laboratories

1.4 QUALITY ASSURANCE/TESTS

A. As a precondition for approval, transfer switch shall be listed by Underwriters Laboratories in their Electrical Construction Materials Catalog under UL 1008 Standard for Transfer Switch Equipment and accepted for use on emergency systems.

B. When conducting temperature rise tests to paragraph 99 of UL 1008, the manufacturer shall include post-endurance temperature rise tests to verify the ability of the transfer switch to carry full rated current after completing the overload and endurance tests.

C. The switch shall meet or exceed the voltage surge withstand capability in accordance with IEEE Standard C37.90.1 and the impulse withstand voltage test in accordance with NEMA Standard ICS 1-109.

1.5 SHOP DRAWINGS

A. Submit shop drawings and product data clearly indicating:

1. Cabinet dimensions.
2. Wiring diagrams.
3. Interrupting or withstanding current rating.
4. All electrical characteristics and data as required to show compliance with these Specifications.

PART 2 - PRODUCTS

2.1 GENERAL

A. The transfer switch shall be double throw manually actuated.

B. The transfer switch shall be capable of transferring successfully in either direction with 70 percent of the rated voltage applied to the switch terminals.

C. The transfer switch shall be equipped with a safe manual operator designed to be operated in the loaded condition and to prevent injury to operating personnel.

D. Transfer switch maximum dimensions shall be as shown on drawings.

E. Acceptable Manufacturers:

1. The transfer switches shall be manufactured by:

a. Schneider Electric (Basis of Design)

b. G.E.

c. Eaton

d. Siemens

PART 3 - EXECUTION

3.1 INSTALLATION

A. The transfer switch shall be installed as shown on the Drawings in accordance with the manufacturer's recommendations and all applicable codes.

B. Provide color-coded cam-lock connectors for connection of a portable generator using portable power cables. Mount in bottom of switch, provide weatherproof covers. Connectors shall be rated equal to the rating of the switch.

END OF SECTION

SECTION 26 41 00 - LIGHTNING PROTECTION for STRUCTURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Grounding and bonding for lightning protection.

B. Air terminals and interconnecting conductors.

1.2 RELATED SECTIONS

A. Section 07 52 00, “Roofing Systems”.

1.3 REFERENCES

A. LPI-175 - Lightning Protection Installation Standard

B. LPI-177 - Inspection Guide for LPI Certified Systems

C. NFPA 780 - Lightning Protection Code

D. UL 96 - Standard for Lightning Protection Components

E. UL 96A - Standard for Installation Requirements for Lightning Protection Systems.

1.4 SYSTEM DESCRIPTION

A. Lightning Protection systems: Provide conductor system protecting roofs consisting of air terminals on roofs, roof-mounted mechanical equipment, chimneys, stacks, steeple, parapets, and penthouse roofs; bonding of structure and other metal objects; grounding electrodes; interconnecting conductors, and irrigation pumps and structure.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittals Procedures for submittals.

B. Shop Drawings:

1. Indicate layout of air terminals, grounding electrodes, and bonding connections to structure and other metal objects.

2. Include terminal, electrode, and conductor sizes and connection and termination details.

C. Product Data: Provide dimensions and materials of each component and include indication of listing in accordance with UL 96.

1.6 PROJECT RECORD DOCUMENTS

A. Submit under Provisions of Section 01 33 00.

B. Record the actual locations of air terminals, grounding electrodes, bonding connections, and routing of system conductors in project record documents.

1.7 QUALITY ASSURANCE

A. Perform work in accordance with NFPA 780.

B. Perform work in accordance with UL 96A and provide master label.

C. Perform work in accordance with LPI-175 and provide LPI certification.

D. Maintain one copy of each document on site.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in lightning protection equipment with minimum 3 years documented experience and member of the Lightning Protection Institute.

B. Installer: Authorized installer of manufacturer with minimum three years documented experience and certified by the Lightning Protection Institute.

1.9 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings.

1.10 COORDINATION

A. Coordinate work with roofing, exterior, and interior finish installations.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Air Terminals: Provide either solid copper or aluminum with adhesive bases for single-ply roof installations.

B. Air Terminal for Chimney: Lead-coated copper

C. Decorations: Ball

D. Grounding Rods: Solid copper

E. Ground Plate: Copper

F. Grounding down conductors and grounding ring electrodes: Copper.

G. Conductors except those noted above copper or aluminum.

H. Connectors and Splicers: Bronze

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with NFPA 780, UL 96A, and LPI-175.

B. Connect conductors using exothermic welding process.

1. Protect adjacent construction elements and finishes from damage.

C. Bond exterior metal bodies on building to the lightning protection system and provide intermediate level interconnecting loops 60 feet on center.

D. Do not install copper lightning protection materials on aluminum roofing, siding, or other aluminum surfaces.

E. Do not install aluminum lightning protection materials on copper surfaces.

F. Protect copper components installed within 24 inches of the top of a chimney or vent emitting corrosive gases by a hot-dipped lead coating or equivalent.

G. Down conductors shall be routed concealed in PVC sleeves installed in the structure.

H. Connect conductor to metal bodies of conductance located within 6' by secondary conductor.

I. Provide lightning protection for buildings, covered walkways, press boxes, scoreboards, and all other structures required by NFPA 780.

3.2 FIELD QUALITY CONTROL

A. Obtain the services of Underwriters Laboratories, Inc. to provide inspection and labeling of the lightning protection system in accordance with UL 96A.

B. Perform inspection and testing in accordance with NFPA 780.

C. Provide owner with an Underwriters Laboratories final certification of the lightning protection system.

D. Contractors' tests shall be scheduled and documented in accordance with the commissioning requirements.

1. Refer to Section 01 91 00 - Commissioning, for further details.

3.3 DEMONSTRATION AND TRAINING

A. Training of the Owner’s operation and maintenance personnel is required in cooperation with the Owner's Representative.

1. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems.
2. Schedule the instruction in coordination with the Owner's Representative after submission and approval of formal training plans.
3. Refer to Section 01 91 00, Commissioning, for further contractor training requirements.

B. Provide demonstration and training for all types of lightning protection systems installed in this project.

END OF SECTION

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SECTION 26 43 00 - SURGE PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification sections, apply to this section.

1.2 SUMMARY

A. Section includes requirements for surge protective devices.

1.3 REFERENCES

A. The latest edition of the following references shall apply to the work of this section:

1. ANSI/IEEE C62.33 Standard Test Specifications for Varistor Surge Protective Devices
2. ANSI/IEEE C62.41 IEEE Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits
3. ANSI/IEEE C62.45 IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000V and Less) AC Power Circuits
4. NFPA 70 National Electrical Code
5. NFPA 780 Standard for Installation of Lightning Protection Systems
6. UL 96A Standard for Lightning Protection Components
7. UL 1363 Standard for Safety Relocatable Power Taps
8. UL 1449, 3rd Edition Standard for Safety for Surge Protective Devices

1.4 REGULATORY REQUIREMENTS

A. Equipment Certification: Surge protective devices shall be listed by Underwriters Laboratories shall bear the UL seal and be marked in accordance with referenced standard. Surge protective devices shall be UL listed and labeled for intended use.

B. Surge protective devices shall be installed and located in accordance with requirements of all applicable National Fire Protection Association (NFPA) codes (including NFPA 70 and NFPA 780).

C. Comply with all standards and guides as listed under “References” above.

1.5 DESIGN REQUIREMENTS

A. Provide and install all materials, labor and auxiliaries required to furnish and install complete surge suppression for the protection of building electrical and electronics systems from the effects of line induced transient voltage surge and lightning discharge as indicated on Drawings or specified in this Section for systems with voltages between 120 VAC and 480VAC (single phase or three phase).

B. Equipment specified covers Surge Protective Devices (SPD).

C. Provide surge protective devices for the following equipment:

1. On each main electrical service panel at each building.
2. On distribution and branch panels as called for on Drawings or in these Specifications.
3. All electronic communications equipment installed under Divisions 27 and 28 including, but not limited to, fire alarm, intercom, security, television, premise distribution, and sound systems.
4. Site lighting pole light circuits.
5. Additional locations as required by NFPA 780.
6. At point of use locations (receptacles, plug-in units) as required.

7. On all automatic transfer switches (ATS).
8. On input to each UPS system.

1.6 SUBMITTALS

A. Submit under provisions of the General Requirements of the Contract Documents and Section Submittals.

B. Submit Product Data for each type of surge protective device:

1. Dimensions.
2. Means of mounting.
3. Compliance with UL Standards referenced.
4. Compliance with IEEE Standards referenced.
5. Design type (Hybrid, MOV).
6. Internal fusing.
7. Recommended overcurrent protection.
8. Size of wire leads.
9. Visual failure indicator.
10. Warranty.
11. Performance data showing compliance with performance as specified herein.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance (O & M) data as called for in Section 26 01 00, “Operation and Maintenance Manuals”.

B. O & M data to include:

1. All accepted shop drawings, product data, and/or cut sheets.
2. Installation, connection, and maintenance information on each type of surge suppression.
3. Procedure and/or timetable for recommended periodic inspection of devices to determine continued usefulness.

1.8 QUALITY ASSURANCE

A. All surge protective devices shall be manufactured by a company normally engaged in the design, development, and manufacture of such devices for electrical and electronics systems equipment.

B. The surge protective device manufacturer shall offer technical assistance through support by a factory representative and local stocking distributor. Factory representatives are to accept installation prior to Substantial Completion.

1.9 COORDINATION/PROJECT CONDITIONS

A. Verify proper grounding is in place.

B. Verify proper clearances, space, etc. is available for surge protective devices.

C. Coordinate so that proper overcurrent device, as recommended by manufacturer, is installed to feed each surge protective device.

1.10 WARRANTY

A. All surge protective devices shall be warranted to be free from defects in materials and workmanship for a period of ten years.

B. Any surge protective device which shows evidence of failure or incorrect operation during the warranty period shall be repaired or replaced by the manufacturer and installer at no cost to the Owner.

1.11 DEFINITIONS/ABBREVIATIONS

A. VPR: UL Voltage Protection Rating

B. MCOV: Maximum Continuous Operating Voltage

C. SCCR: Short Circuit Current Rating

D. IN: Inominal

PART 2 - PRODUCTS

2.1 GENERAL

A. Surge protective devices shall be designed for the specific type and voltage of electrical service and shall provide clamping action for both normal (L-N) and common (N-G) mode protection.

B. Surge protective devices shall be of a hybrid design, and include circuitry with tight, wave-tracking clamping characteristics.

C. Surge protective devices shall be designed to withstand a maximum continuous operating voltage of not less than 115 percent of nominal RMS line voltage.

D. Surge protective devices shall contain internal safety fusing to disconnect the surge protective device from the electrical source if the surge protective device fails, in order to prevent catastrophic failure modes.

E. Surge protective devices shall be fail safe, shall allow no follow-through current, shall have repeated surge capability, shall be solid state, shall be self-restoring, and shall be fully automatic.

F. Surge protective devices shall be UL 1449 listed under UL Category Code VZCA and shall be accepted for the location in which they are installed.

2.2 SERVICE ENTRANCE SURGE PROTECTIVE DEVICES

A. General: Provide service entrance surge protective devices on each main electrical service panel at each building and/or structure. Surge protective devices shall meet or exceed the following (in addition to requirements under ‘General’ above):

1. Surge protective devices shall be tested per UL 1449 requirements to determine voltage protection rating (VPR).
2. Surge protective devices shall be sequential surge tested as per IEEE C62.45, and shall withstand 1000 test cycles at 10 kA, Cat. C3 test criteria.
3. Enclosure:
    a. UL listed
    b. Fire retardant
    c. NEMA 1 or 3R as required for each location.
    d. Flush, Switchboard and/or Surface mounted as required for each location.

B. Modular Design:

1. Replaceable module design. The panel mounted surge protective device shall be designed with replaceable modules for purposes of in-service replacement.
2. The surge protective device shall be designed with redundant back-up surge protection in the event of a module failure.
3. Module status indicators shall be provided to indicate individual module status. When a module has failed, the module LED status indicator shall indicate said failure.
4. Unit status indicators shall be provided to indicate the status of the complete surge protective device. The LED status indicators shall be located on the hinged front cover to redundantly indicate module or unit failure.

5. Minimum Surge Capacity:
    a. 240,000 amps. per phase.
6. Voltage Protection Ratings (VPR) and Maximum Continuous Operating Voltage. Comply with the following maximum voltages for UL 1449 testing requirements:

240 kA Unit	L-L	L-N	L-G	N-G	MCOV	In
120/208 V, 3ph, 4W, wye					150V	
UL 1449	1200V	700V	700V	700V		20 kA
277/480 V, 3ph, 4W, wye					320V	
UL 1449	2000V	1200V	1200V	1200V		20 kA

7. Short Circuit Current Rating:
    a. 100,000 amps.
8. Manufacturers
    a. 240 kA Units
        i. LEA International PV400 Series for applied voltage in enclosure as required on Drawings, as specified above, and/or as required by applicable codes.
        ii. Advanced Protection Technologies TE/xxXAS/25 Series for applied voltage in enclosure as required on Drawings, as specified above, and/or as required by applicable codes.
        iii. Atlantic Scientific ZoneMaster 240 All Mode Series for applied voltage in enclosure as required on Drawings, as specified above, and/or as required by applicable codes.

2.3 SECOND LEVEL SURGE PROTECTIVE DEVICES AND UPS/ATS SYSTEMS.

A. General. Provide second level surge protective devices on each second level of the distribution system (including sub panels) and on all major electronic equipment including UPS Systems and ATS Systems. Surge protective devices shall meet or exceed the following (in addition to requirements under ‘General’ above):
    1. Surge protective devices shall be tested as per UL 1449 requirements to determine voltage protection ratings (VPR - 3 kA).
    2. Surge protective devices shall be sequential surge tested as per IEEE C62.45, and shall withstand 1000 test cycles at 3 kA, Cat. B3 test criteria.
    3. Enclosure:
        a. UL listed.
        b. Fire retardant.
        c. NEMA 1 or 3R as required for each location.
        d. Flush, Switchboard and/or Surface mounted as required for each location.

B. Non-Modular Design:
    1. Status indicators shall be provided to indicate individual module status. When a module has failed, the module LED status indicator shall indicate said failure. The LED status indicators shall be located on the front cover to redundantly indicate module or unit failure.
    2. Minimum Surge Capacity:
        a. 100 kA per phase.
    3. Voltage protection rating (VPR) and maximum continuous operating voltage. Comply with the following maximum voltages for UL 1449 testing requirements:

100 kA Unit	L-L	L-N	L-G	N-G	MCO V	In
120/208 V, 3ph, 4W, wye					150V	
UL 1449	1000V	700V	700V	600V		20 kA
277/480 V, 3ph, 4W, wye					320V	
UL 1449	2000V	1200V	1200V	1200V		20 kA

4. Short Circuit Current Rating: 100,000 amps.
5. Manufacturers:
    a. 100 kA Units:
        i. Advanced Protection Technologies Series TE/***XDS/10 for applied voltage in enclosure as required on drawings, as specified above, and/or as required by applicable codes.
        ii. LEA International SP100 Plus Series for applied voltage in enclosure as required on Drawings, as specified above, and/or as required by applicable codes.
        iii. Atlantic Scientific Zone Sentinel Series for applied voltage in enclosure as required on drawings, as specified above, and/or as required by applicable codes.

2.4 EXTERIOR LIGHTING POLES CIRCUITS

A. Provide surge arrester in pole handhole.
B. Surge arrester shall be UL listed as a Type 1 surge arrester.

2.5 SERVICE SURGE ARRESTER

A. Service surge arrester shall be UL listed as Type 1 surge arrester and as required to comply with Local Authority Having Jurisdiction and UL 96A requirements.
B. This suppressor shall be connected on the line side of service to each building and where required to meet UL 96A.
C. 50 kA per phase rating.
D. Minimum short circuit current rating: 200,000 amps
E. Enclosure:
    1. NEMA 4X polycarbonate
F. Manufacturers:
    1. Advanced Protection Technologies SPDEE Series for applied voltage
    2. Atlantic Scientific Zone Defender Curve Series for applied voltage

2.6 POINT OF USE LOCATION (120 VOLT)

A. UL 1449 listed.
B. 20 Amp, 120V rated. All components must be 20 Amp rated.
C. Surge protection devices shall be tested per IEEE C62.41 for Categories A and B.
D. Normal mode (L - N), and common mode (L+N-G) protection.
E. Internal fusing.
F. Hybrid design.
G. Indicators for normal operation and failure indication.
H. Enclosure:
    1. Fire retardant high impact, phenolic or plastic housing or metal enclosure.

I. Clamping voltage UL 1449, Line to Neutral, Category B impulse at (3 kA, 8 x 20 µs): 350V @ 120V.

J. Maximum Surge Capacity: 26,000 Amps.

K. Maximum continuous operating voltage: 115 percent of line voltage.

L. Provide hardwire connection or add 20-amp receptacle device to hardwired devices to match equipment being protected and maintain UL Listing. Devices shall be a feed-through design. Parallel connected devices are not acceptable.

M. Manufacturers:

1. Leviton 51020-WM

2.7 POWER PLUG-IN UNITS

A. UL 1449 Listed.

B. 15 Amp, 120V rated. All components must be 15 Amp rated.

C. Surge protection devices shall be tested per IEEE, C62.41 for Categories A and B.

D. Normal mode (L - N), and common mode (L+N-G) protection.

E. Internal fusing. Resettable circuit breaker.

F. Hybrid design.

G. Operational indicator lamp.

H. Enclosure:

1. Fire retardant high impact, phenolic or plastic housing or metal enclosure.

I. Clamping voltage UL 1449, Line to Neutral, Category B impulse at (3 kA, 8 x 20 µs): 350V @ 120V.

J. Maximum Surge Capacity: 13,000 Amps.

K. Maximum continuous operating voltage: 115 percent of line voltage.

L. Manufacturers:

1. Control Concepts SP Series
2. Leviton
3. Wiremold

PART 3 - EXECUTION

3.1 GENERAL

A. Provide, install, and connect surge protective devices at first piece of electrical equipment (panel, switchboard, ATS, etc.) that the electrical service encounters as it enters the facility.

B. Provide, install, and connect surge protective devices at each branch panel as noted on drawings.

C. Provide, install, and connect surge protective devices at each Automatic Transfer Switch (ATS) and Uninterruptible Power Supply (UPS) in project whether shown on Drawings or not.

D. Provide, install, and connect surge protective devices in pole near hand hole of all exterior lighting poles whether shown on Drawings or not.

E. Provide, install, and connect surge protective devices at location where Divisions 27 and 28 equipment is connected to line voltage (120V). Provide cords and receptacles as required to connect surge protective devices to equipment being protected and maintain UL listing.

F. Provide surge protective devices at panel feeding exterior site lighting circuits for each panel feeding site lighting.

3.2 INSTALLATION OF SURGE PROTECTIVE DEVICES

A. Surge protective devices for other than Divisions 27 and 28 equipment shall be installed as close as practical to the electric panel or electronic equipment to be protected, consistent with available space.

B. Surge protective devices for Divisions 27 and 28 equipment power source shall be coordinated with the individual specification section contractor. Locate in terminal cabinet with surge protective devices and bond together.

C. Surge protective devices shall be close nipped to the device being protected in a position near the neutral bus which will minimize lead length between surge protective devices and the buses or control breaker to which the surge protective device connects. Suppressor leads shall not extend beyond the surge protective device manufacturer's recommended maximum lead length without specific acceptance of the Engineer.

D. Location shown on Drawings is diagrammatic only. Provide flush mount trim for surge protective device units at flush mounted panelboards. Provide NEMA 4X enclosures for TVSS units in exterior locations.

E. Surge protective devices shall be installed in a neat, workmanlike manner. Lead dress shall be as short and as straight as possible and be consistent with recommended industry practices for the system on which these devices are installed.

F. Supplementary grounding and bonding connections required between the bonding bus or ground plane for each equipment cluster and other locations as indicated herein shall be accomplished using #6 AWG core copper conductor and accepted connections unless otherwise noted. Referenced to a common earth ground.

G. Surge protective devices shall be installed in a manner that allows simple replacement within short periods of downtime.

H. Surge protective devices other than point of use type and those for exterior lighting poles shall be installed with a means of disconnecting the suppressor at the panel. At the main service entrance location, provide a dedicated 30-amp, 3 phase CB, 100,000 AIC for the surge protective device. At the distribution secondary and/or subpanels location, provide dedicated 20 amp or 30-amp, 3 phase CB, for the surge protective device. Labels disconnect or CB "Surge Protector." Fused disconnects may be substituted for the CB, with the acceptance of the Engineer. Contractor to change rating of CBs noted above as required to properly provide system as recommended by manufacturer.

END OF SECTION

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SECTION 26 51 14 - INTERIOR LIGHTING

PART 1: GENERAL

1.1 RELATED DOCUMENTS

A. The other Contract Documents complement the requirements of this Section. The General Requirements apply to the work of this Section.

1.2 SCOPE

A. Provide lighting fixtures, accessories, labor, and supervision necessary to install a complete Interior Lighting System.

1.3 STANDARDS AND CODES

A. Except where otherwise required by this Section, the following Standards and Codes shall govern:
   1. NEC Article 410
   2. UL Listed
      a. 1310 and 8750 – Light Emitting Diode (LED) equipment for use in lighting products.
   3. American National Standards Institute (ANSI)
      a. ANSI C82.11 – Performance requirement for high frequency ballasts
      b. ANSI/IES RP-16-10 – Nomenclature and definitions for illuminating engineering
      c. ANSIE1.20 - Remote Device Management over DMX512 Networks
      d. ANSI C62.41 – Recommended practice in low power circuits
   4. International Electrotechnical Commission (IEC).
      a. IEC 61347-1 – General and safety requirements for lamp control gear
      b. IEC 61347-2-13 – Particular requirements for electronic control gear for LED modules
      c. IEC 62384 - DC or AC supplied electronic control gear for LED modules – performance requirements
      d. IEC 61000-3-2 - Harmonic current emissions
      e. IEC 61547 - EMC immunity requirements
      f. IEC 62386-101/102/207 – Digital addressable lighting interface (DALI)
   5. Federal Communications Commission (FCC) rules – Part 15 Class B: Radio Frequency Devices.
      a. Commercial rated
   6. Entertainment Services and Technology Association
      a. ESTA E1.3 - Entertainment Technology - Lighting Control System - 0 to 10V Analog Control Protocol

1.4 SUBMITTALS

A. Submit catalog cuts giving complete description of fixtures to include photometric curves and method of installation.

B. Submit index listing all fixtures and complete model with submittal.

1.5 QUALIFICATION

A. The lighting fixtures listed in the fixture schedule are the basis of design for the lighting systems. Substitutions will be considered per the General Conditions in Division 1 of this specification.

B. Final review for fixtures will be when shop drawings are submitted. The Architect reserves the right to reject any fixtures which, in his opinion, do not meet the overall lighting system design. Upon request, the fixture supplier shall submit sample fixtures.

PART 2: PRODUCTS

2.1 LED FIXTURES

A. LED fixture housings shall be die-formed of cold rolled steel of not less than 22 gauge. Construction shall provide an approved method of locking lens, shielding in place, and integral lensing. Enamel finish for light reflectance shall have a hardness between H and 3H. Before enamel is applied, the metal shall be cleaned and prepared by "Bonderizing" or an equivalent process. All paint shall have a minimum reflectivity of 88%.

B. Plastic lenses for fixtures shall be 100% virgin acrylic, not less than 1/8 inch nominal thickness. All lenses in kitchen and damp areas shall have smooth side down and shall have triple gaskets.

C. Temperature around ballast and in fixture housing shall not exceed manufacturer's recommendations with ambient room temperature of 27-degrees C.

D. All LED fixtures shall be equipped with a ground screw or lug to ensure mechanical bond.

E. All LED fixtures shall have an "in-line" fuse on the ungrounded primary contactor of each ballast. They shall be buss type GLR holders with GLR fuses of size required.

F. Recessed fixtures in plaster ceilings shall be furnished with plaster frames.

G. Fixtures that, according to drawing symbol list, are to have emergency battery back-up shall have a Bodine "BSL" series unit or equivalent installed. The unit shall be UL approved according to "UL-924" and provide a minimum of 1400 lumen output while on battery power for a minimum of 90 minutes. It shall mount in fixture wireway, be compatible with standard and energy saving lamps, and have dual primary leads for use on either 120-volt circuits.

H. Prior to placing orders for recessed LED fixtures, Contractor shall verify the types of ceilings and suspension systems that have been approved for the project and shall order fixtures with flanges as required to fit in the approved ceilings.

I. Where multi-level switching is shown, the correct number of drivers shall be provided in each fixture to accommodate the switching scheme.

2.2 LAMPS

A. LED shall have an integral thermal management system for protection and long life.

B. TM-21 & LM-70 testing.

C. SDCM color binning and warranty for color consistency over the life.

2.3 LED DRIVERS - EQUIPMENT

A. Basis of design Manufacturer: eldoLED.

B. LED dimming shall be equal in range and quality to a commercial grade incandescent dimmer. Quality of dimming to be defined by dimming range, freedom from perceived flicker or visible stroboscopic flicker, smooth and continuous change in level (no visible steps in transitions), natural square law response to control input, and stable when input voltage conditions fluctuate over what is typically experienced in a commercial environment. Demonstration of this compliance to dimming performance will be necessary for substitutions or prior approval.

C. Ten years expected life while operating at maximum case temperature and 90 percent non-condensing relative humidity.

D. Driver must limit inrush current.

1. Base specification: Meet or exceed NEMA 410 driver inrush standard of 430 Amps per 10 Amps load with a maximum of 370 $Amps^2$ – seconds.
2. Preferred Specification: Meet or exceed 30mA^2s at 277VAC for up to 50 watts of load and 75A at 240us at 277VAC for 100 watts of load.

E. Withstand up to a 1,000-volt surge without impairment of performance as defined by ANSI C62.41 Category A.

F. No visible change in light output with a variation of plus/minus 10 percent line voltage input.

G. Total Harmonic Distortion less than 20% percent and meet ANSI C82.11 maximum allowable THD requirements at full output. THD shall at no point in the dimming curve allow imbalance current to exceed full output THD.

H. Driver must support automatic adaptation, allowing for future luminaire upgrades and enhancements and deliver improved performance:
   1. Adjustment of forward LED voltage, supporting 3V through 55V.
   2. Adjustment of LED current from 200mA to 1.05A at the 100 percent control input point in increments of 1Ma.
   3. Adjustment for operating hours to maintain constant lumens (within 5 percent) over the 50,000-hour design life of the system and deliver up to 20 percent energy savings early in the life cycle.

I. Driver must be able to operate for a (+/- 10%) supply voltage of 120V through 277VAC at 60Hz.

J. Driver should be UL Recognized under the component program and shall be modular for simple field replacement. Drivers that are not UL Recognized or not suited for field replacement will not be considered.

K. Driver shall include ability to provide no light output when the analog control signal drops below 0.5V or the DALI/DMX digital signal calls for light to be extinguished and shall consume 0.5 watts or less in this standby. Control deadband between 0.5V and 0.65V shall be included to allow for voltage variation of incoming signal without causing noticeable variation in fixture-to-fixture output.

2.4 LED DRIVERS – LIGHT QUALITY

A. Over the entire range of available drive currents, driver shall provide step-free, continuous dimming to black from 100 percent to 0.1 percent and 0% relative light output, or 100 – 1% light output and step to 0% where indicated. Driver shall respond similarly when raising from 0% to 100%.
   1. Driver must be capable of 20-bit dimming resolution for white light LED drivers or 15-bit resolution for RGBW LED drivers.

B. Driver must be capable of configuring a linear or logarithmic dimming curve, allowing fine grained resolution at low light levels.

C. Drivers to track evenly across multiple fixtures at all light levels and shall have an input signal to output light level that allows smooth adjustment over the entire dimming range.

D. Driver and luminaire electronics shall deliver illumination that is free from objectionable flicker as measured by flicker index (ANSI/IES RP-16-10). At all points within the dimming range from 100-0.1 percent luminaire shall have:
   1. LED dimming driver shall provide continuous step-free, flicker free dimming similar to incandescent source.
   2. Base specification: Flicker index shall less than 5% at all frequencies below 1000 Hz.
   3. Preferred specification: Flicker index shall be equal to incandescent, less than 1% at all frequencies below 1000 Hz.

2.5 LED DRIVERS – CONTROL INPUT

A. 4-Wire (0-10V DC Voltage Controlled) Dimming Drivers
   1. Must meet IEC 60929 Annex E for General White Lighting LED drivers.
   2. Connect to devices compatible with 0 to 10V Analog Control Protocol, Class 2, capable of sinking 0.6 ma per driver at a low end of 0.3V. Limit the number of drivers on each 0-10V control output based on voltage drop and control capacity.
   3. Must meet ESTA E1.3 for RGBW LED drivers.

B. Digital (DALI Low Voltage Controlled) Dimming Drivers
   1. Must meet IEC 62386.

C. Digital Multiplex (DMX Low Voltage Controlled) Dimming Drivers
   1. Must meet DMX / RDM: USITT DMX512A and ANSI E1.20 (Explore & Address)
   2. Capable of signal interpolation and smoothing of color and intensity transitions

PART 3: EXECUTION

3.1 INSTALLATION

A. Install fixtures; coordinate exact location with Architect's reflected ceiling plan.

B. Recessed fixtures in removable ceilings shall be connected to the branch circuit with 1/2 inch minimum flexible conduit and branch circuit wire no smaller than No. 12 from an

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accessible junction box. Where fixture housings are connected together, use 90-degree C wire for branch circuit feed through fixture channels. All flex fittings shall be case hardened locknuts with insulated throats.

C. Fixtures shall be grounded. Lamp sockets shall be wired so that the outer shell is connected to the neutral grounded conductor.
D. Fixtures recessed in furred ceiling shall be installed so that they can be removed from below the ceiling.
E. Fixtures installed in plastered ceiling shall not be supported directly from the ceiling. Support fixtures from the ceiling supports.
F. Fixtures installed in acoustical tile ceilings shall be attached to the ceiling grid at all four corners with Hurricane Clips. The main runners of the ceiling grid shall be supported within 6 inches of each corner of the fixture.
G. Lighting control system vendor shall provide commissioning, programming, and 4 hours of on-site training of the owner's representative.
H. To be installed per manufacturers prescribed methods.
I. Driver may be remote mounted up to 300 ft. (100 m) depending on power level and wire gauge.
J. 0-10V input shall be protected from line voltage mis-wire and shall be immune and output unresponsive to induced AC voltage on the control leads.

END OF SECTION

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SECTION 26 52 13 - EMERGENCY LIGHTING EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the sections included under Division 1, General Requirements, are included as a part of this section as though bound herein.

1.2 SUMMARY

A. Light fixtures furnished under this Division shall be furnished complete with lamps and all necessary trim and mounting hardware and installed as shown on the drawings.

B. Light fixtures shall be neatly and firmly mounted, using standard supports for outlets and fixtures.

C. Lamps shall be included in the system guarantee for a period of 30 days after final acceptance of the building.

1.3 SECTION INCLUDES

A. Emergency lighting units.

B. Emergency exit signs.

C. Emergency fluorescent lamp power supplies.

1.4 REFERENCES

A. FS W-L-305 - Light Set, General Illumination (Emergency or Auxiliary)

B. NFPA 101 -Life Safety Code

C. NEMA WD1 - General-Purpose Wiring Devices.

D. ADA - Americans with Disabilities Act of 1990.

E. ANSI C78.379 - Electric Lamps - Incandescent and High - Intensity Discharge Reflector Lamps - Classification of Beam Patterns.

F. ANSI C82.1 - Ballasts for Fluorescent Lamps - Specifications.

G. ANSI/NFPA 70 - National Electrical Code.

H. Florida Building Code (FBC)

I. Florida Fire Prevention Code (FFPC)

1.5 SUBMITTALS

A. Submit Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.

1. Shop drawings shall be submitted for all fixtures that require modifications either as specified or as required to fit these projects architectural field conditions (i.e., specialty exit signs).

2. Shop drawings shall be complete showing all dimensions and installation instructions required for this project’s conditions.

B. Submit Product Data: Provide dimensions, ratings, and performance data. Product data shall be submitted for all fixtures showing:

1. dimensions

2. UL Label

3. fusing

4. metal gauge

5. lens/louver thickness

6. finish
7. voltage
8. lamps
9. batteries

1.6 OPERATION AND MAINTENANCE DATA

A. Submit Maintenance Data: Include replacement parts list.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum 5 years' experience.

1.8 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Conform to requirements of NFPA 101.

C. Conform to requirements of ADA.

D. Conform to requirements of FBC.

E. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.9 PRODUCT STORAGE AND HANDLING

A. Physically protect fixtures against damage as recommended by manufacturer.

1.10 MAINTENANCE MATERIALS

A. Provide to Owner:

1. Ten of each size/type of fuses.
2. Six of each type of lamps.

1.11 WARRANTIES

A. All fixtures furnished under this Division shall be covered by a warranty of not less than 5 years from date of final completion against defects. Warranty shall include payment for normal labor costs of replacement of inoperative in-warranty fixtures.

PART 2 - PRODUCTS

2.1 LUMINAIRES/FIXTURES

A. Furnish products as specified in schedule on Drawings.

B. Install ballasts, lamps, and specified accessories at factory.

C. All light fixtures shall adhere to UL Test Standard #1571 and Article #410-65C of the National Electrical Code. All manufacturers shall provide the required thermal protection as required.

2.2 SELF-CONTAINED EMERGENCY POWER EXIT SIGNS

A. Type: Exit signs with integral battery-operated emergency power supply, including power failure relay, test switch, AC ON pilot light, battery, and fully automatic two-rate charger.

B. Battery: Sealed nickel cadmium cell, requiring no maintenance or replacement for 10 years under normal conditions. Batteries to have a 9 year warranty and provide for 90 minute capacity.

C. Exit sign fixture shall be suitable for use as emergency lighting unit.

D. Exit sign shall have universal mount, universal arrows, down light, stencil face. Arrows shall be as shown on drawings.

E. Exit signs to have long life LED lamps for normal and emergency operation; integral battery; battery charger; transformer; test switch; and LED charge monitor light.

F. Transformer shall be dual rated for 120 or 277 volts.

G. Furnish all lamps required.

H. Charger shall comply with UL 924.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units plumb and level.

B. Adjust units as required to align with building lines and with each other. Secure to prohibit movement.

C. Adjust exit sign directional arrows as indicated. Re-adjust at project completion as required by authority having jurisdiction.

D. Install illuminated exit signs as shown on drawings, as herein specified, or as required by applicable codes.

E. Connect exit signs, inverter/battery units to local lighting circuit ahead of all switches.

F. Install suspended exit signs using pendants supported from swivel hangers.

G. Mount all exit signs at 7'-6" AFF to bottom of fixture or as required to meet ADA requirements. Provide all mounting accessories/hardware as required for proper mounting including pendant/swivel hangers.

END OF SECTION

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SECTION 26 56 00 - EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the sections included under Division 1, General Requirements, are included as a part of this section as though bound herein.

1.2 SUMMARY

A. Light fixtures furnished under this Division shall be furnished complete with lamps and all necessary trim and mounting hardware and installed as shown on the drawings.

B. Light fixtures shall be neatly and firmly mounted.

C. Lamps shall be included in the system guarantee for a period of 30 days after final acceptance of the project.

D. Provide and install concrete base as noted on drawings. Construct concrete base per applicable section and/or division of the specifications.

1.3 SECTION INCLUDES

A. Exterior luminaires and accessories.

B. Poles.

1.4 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code

B. IES RP-8 - Roadway Lighting

C. IES RP-20 - Lighting for Parking Facilities

D. ASCE 7-10 - Minimum Design Loads of Buildings and Other Structures

E. IES - Illuminating Engineering Society

F. NESC - National Electrical Safety Code

G. FBC - Florida Building Code

1.5 SUBMITTALS

A. Submit point to point photometric analysis of the entire job site to the property line. Utilize photometric data obtained from submitted fixtures only. Verify that all submitted fixture types and light levels are compliant with all local codes, ordinances, and the Authority Having Jurisdiction. Submittal will not be reviewed by the A/E without this narrative data.

B. Submit Product Data: Provide dimensions, ratings, and performance data. Product data shall be submitted for all light fixtures showing:

1. Dimensions
2. UL label
3. Fusing
4. Luminaires disconnect.
5. metal gauge
6. lens thickness
7. finish
8. voltage
9. lamps
10. lightning arrester, surge arrester/, and/or surge protection device

C. Submit drawings on concrete base complete with rebars, etc.

1.6 PROJECT RECORD DOCUMENTS

A. Submit record documents to accurately record actual locations of each luminaire.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit Maintenance Data: Include instructions for maintaining luminaires.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum 5 years' experience.

1.9 REGULATORY REQUIREMENTS

A. Conform to requirements of the following:

1. ANSI/NFPA 70
2. FBC and ASCE 7-10
3. IES
4. NESC

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to site.

B. Accept products on site. Inspect for damage.

C. Protect poles from finish damage by handling carefully.

D. Store and handle solid wood poles in accordance with ANSI O5.1.

1.11 COORDINATION

A. Furnish bolt templates and pole mounting accessories to installer of pole foundations.

PART 2 - PRODUCTS

2.1 GENERAL

A. All lighting fixtures mounted outdoors subject to dampness and insects shall have gasketing material between lens door and frame to completely seal interior of fixture. Knockouts and holes in fixtures housing shall be closed and sealed. All fixtures shall be complete with lamps, shielding, brackets, concrete bases, anchor bolts and all necessary fittings and accessories for a complete installation.

B. Furnish products as specified on Drawings.

C. All exterior light fixtures shall not have any labels exposed to normal viewing angles. This includes manufacturer labels and UL labels. All labels shall be concealed within the body of the fixture and/or luminaire. No manufacturer's name or logo shall appear on the exterior of any light fixtures unless accepted in writing by the engineer.

D. All light fixtures shall adhere to UL Test Standard #1571 and NEC 410.115(C). All manufacturers shall provide the required thermal protection as required.

E. Pole luminaires, poles, and concrete bases shall comply with applicable requirements of IES, NESC, ASCE, FBC, .and including but not limited to their requirements for illumination, uniformity, construction, wind loading, pole setback, breakaway, installation, glare criteria.

F. All site lighting fixtures/luminaries that may spill light onto adjacent properties shall have glare control shield installed on all fixtures/luminaries as required to meet the glare control requirements of applicable codes and standards. Add required glare control shield to order/model number of all site lighting fixtures.

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2.2 FIXTURES

A. All light sources shall be LED.

B. All fixtures and poles shall be as scheduled and detailed on the drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine excavation and concrete foundation for lighting poles.

B. Examine each luminaire to determine suitability for lamps specified.

3.2 INSTALLATION

A. Install all fixtures in accordance with manufacturers' written instructions, NEC, IES, ASCE, FBC, and NESC.

B. Install lighting poles at locations indicated.

C. Install poles plumb. Provide double nuts to adjust plumb. Grout around each base.

D. Install lamps in each luminaire.

E. Bond luminaires, metal accessories and metal poles to branch circuit equipment grounding conductor. Provide supplementary grounding electrodes at each pole. See Section Grounding and Bonding.

F. Where ceiling mounted fixtures are called for in the Light Fixtures Schedule and on the drawings, this Contractor shall provide fixture trims and supports as required to match type of ceiling system which will be furnished. No ceiling fixtures shall be ordered until the Ceiling System Installer has given written acceptance of the method and location of fixture hanging and fixture type. Fixtures supported by suspended ceiling systems shall be securely fastened to the ceiling framing member by mechanical means, such as bolts, screws, or rivets. Clips identified for use with the type of ceiling framing member(s) and fixture(s) shall also be permitted.

G. All exterior post/pole mounted light fixtures shall have hand hole near base. Hand hole shall provide easy access to light fixture fusing and lightning protection ground lug. Lightning protection ground lug shall be provided inside post/pole, electrically in contact with pole, for connection to ground rod. Provide and install ground wire from ground lug to ground rod, concealing ground wire through post/pole base. Anchor bolts to be galvanized.

H. Pole installation shall comply with wind loading criteria stated in ASCE 7-10 and Florida Building Code. Use V velocity = 140 mph; and the formulas and tables presented in ASCE 7-10.

I. Provide soil compacting and/or treatment to assure wind loading can be achieved for direct buried poles.

J. Duct seal shall be installed to seal all conduits entering exterior light fixtures from underground.

K. Lightning arrester and in-line fusing to be located at handhole location of pole for easy access.

L. Verify all fluorescent fixtures have a luminaire disconnect. Provide luminaire disconnect in any luminaires where factory failed to install luminaire disconnect.

3.3 FIELD QUALITY CONTROL

A. Operate each luminaire after installation and connection. Inspect for improper connections and operation.

3.4 ADJUSTING

A. Aim and adjust luminaires to provide illumination levels and distribution as directed.

B. Re-lamp luminaires which have failed lamps at Date of Substantial Completion.

3.5 GLARE CONTROL

A. Provide, install, and adjust glare control shields to prevent light glare on adjacent properties.

3.6 CLEANING

A. Clean electrical parts to remove conductive and deleterious materials.

B. Remove dirt and debris from enclosure.

C. Clean photometric control surfaces as recommended by manufacturer.

D. Clean finishes and touch up damage.

E. Luminaires:

1. Clean free from dust and dirt. Wash lens and glassware using cleaner such as "Windex" and dry with absorbent paper. Clean plastic per manufacturer's recommendations; do not wipe. Lenses which are kept in original containers until immediately prior to final inspection may not require cleaning. Clean "Alzak" aluminum surfaces (reflectors, fixture cones and the like) per manufacturer's recommendations being careful to remove fingerprints and smudges.
2. It is the Contractor's responsibility to remove any UL labels or manufacturer’s labels from areas of fixture exposed to view and relocate label to non-obtrusive area on fixture.

END OF SECTION

SECTION 27 05 00 - COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Common work results for communications systems including general project requirements, other related specification sections, communications references, standards, definitions, abbreviations and acronyms, quality control requirements, communication submittals to include shop drawings, product and material data sheets, project record documentation, testing, certification, and other items required, for complete functioning communications system.

1.2 REFERENCES

A. See Section 01 42 00 – References for additional reference standards, definitions, abbreviations, and acronyms.

B. Florida Building Code, 2023 Edition.

C. NFPA 70 National Electrical Code, 2020 Edition

D. Telecommunications Standards:

1. ANSI/TIA/EIA standards and BICSI methodologies (TDMM and CO-OSP). Reference to term “telecommunications network”, is hereinafter referred to as Information Transport System Installation (ITSI).

2. Methodologies refers to BISCI manuals for telecommunications design and CO-OSP.

E. American Standards for Testing Materials (ASTM).

F. Underwriters Laboratories (UL).

1.3 REFERENCES, DEFINITIONS, AND ACRONYMS

A. See Section 01 42 00 – References for additional reference standards, abbreviations, definitions, and acronyms.

B. See BICSI Dictionary, 3rd Edition for additional work meanings for communications work.

C. Structured Cabling System Description:

1. Information Transport System includes copper and optical fiber, and equipment owned by outside providers carrying Owner information. Pathways are not limited to Owner’s system but may include those owned by third parties. Information Transport System may be referred to as “the network.” Elements of Information Transport System to be handled uniquely within overall Information Transport System will be specifically addressed (e.g., fire alarm cabling). This term replaces telecommunication network in building codes, standards, or methodologies.

2. Inside Cable Plant elements includes work area outlet assembly, cabling to workstation from network rooms, backbone cabling within buildings, backbone cabling running between physically contiguous buildings, network racks and hardware (routers, switches, hubs, firewalls, etc.), patch panels, punch blocks, fiber distribution panels, patch cords, and cross-connect cables/wires. Inside Cable Plant will be referred to as “ISP.”

3. Outside Cable Plant: The part of the Information Transport System running between buildings, from building to a definable exterior point, between definable exterior points, or from a non-Owner source to Owner’s building or definable exterior point, including termination punch blocks, fiber distribution panels, interior splices for outside to inside optical fiber transition, and other initial device into which outside cable attaches. The Outside Cable Plant does not include backbone cable running between physically contiguous buildings unless cabling enters OSP pathway element (e. g. OSP conduits, maintenance holes, etc.). Outside Cable Plant includes underground cabling and aerial cabling. Outside Cable Plant may be referred to as “OSP.”

D. Specific Communication System Elements:

1. Alien Crosstalk: emissions from one or more adjacent cables affecting wire pairs in other cables.
2. Attenuation: decrease in magnitude or signal power loss propagated between two points.
3. Cable: assembly of one or more insulated conductors or optical fibers, within enveloping sheath.
4. Campus: includes buildings owned or leased by Owner with direct physical cable connection to contiguous campus through Owner's owned or leased conduits, including pathways.
5. Dead pairs: unused copper pairs terminating within splice case, but without being spliced to outgoing cable.
6. Conductor: usually a rod, pipe, or plate (or group of conductors) in direct contact with earth for purpose of providing low-impedance connection to the earth.
7. Grounding electrode conductor: conductor used to connect grounding electrode to equipment grounding conductor, or to grounded conductor of circuit at service equipment, or at the source of separately derived system.
8. Hand-box: rectangular or square underground pathway element similar to small maintenance hole, which cannot be fully entered, that allows for pulling point or splice point in pathway.
9. Handhole: round underground pathway element similar to hand box, which cannot be fully entered, that allows for pulling point in pathway.
10. Identifier: information that links specific element of Information Transport System infrastructure with its corresponding record.
11. Infrastructure (Information Transport System): collection of Information Transport System components, excluding equipment that together provides basic support for distribution of information within or between buildings.
12. Linkage: connection between record and identifier or between records.
13. Maintenance holes: underground pathway element large enough for person to fully enter work, used to provide access to underground cable to pull, splice, and maintain. Formerly known as manhole.
14. Media (Information Transport System): wire, cable, or conductors used for Information Transport System.
15. Outlet box: metallic or nonmetallic box used to hold Information Transport System outlets/connectors or transition devices.
16. Outlet/connector (Information Transport System): connecting device in work area on which horizontal cable or outlet cable terminates.
17. Pathway: facility for placement of Information Transport System cable.
18. Record: collection of detailed information related to specific element of Information Transport System infrastructure.
19. Report: presentation of collection of information from various records.
20. Space (Information Transport System): an area used for housing installation and termination of Information Transport System equipment and cable, e.g., equipment rooms, network rooms, work areas, and maintenance holes/hand boxes/handholes.
21. Splice: joining of conductors in splice closure, meant to be permanent.
22. Splice box: box, located in pathway run, intended to house cable splice.
23. Splice closure: device used to protect splice.

24. Termination position: discrete element of termination hardware where information Transport System conductors are terminated.
25. Wire Map: method used to identify wiring errors.
26. Work area (workstation): building space where the occupants interact with Information Transport System terminal equipment.

E. Communications System Acronyms:

1. ACR: Attenuation-to-Crosstalk Ratio.
2. ADA: Americans with Disabilities Act.
3. AFF: Above finished floor.
4. ANSI: American National Standards Institute.
5. ASTM: American Society for Testing and Materials (ASTM International)
6. AWG: American Wire Gauge
7. BICSI®: Building Industry Consulting Service International.
8. dB: Decibel.
9. EIA: Electronic Industries Alliance.
10. ELFEXT: Equal Level Far-End Crosstalk.
11. EMC: Electromagnetic Compatibility.
12. EMI: Electromagnetic Interference.
13. FCC: Federal Communications Commission.
14. FEXT: Far-End Crosstalk.
15. FOTP: Fiber Optic Test Procedure.
16. Freq: Frequency.
17. GE: Grounding equalizer (replacing TBBIBC).
18. Gnd: Ground.
19. HB: Hand box.
20. HH: Handhole.
21. HVAC: Heating, Ventilation, and Air Conditioning.
22. Hz: (Hertz) or MHz (Megahertz).
23. IDC: Insulation Displacement Connectors.
24. IEEE: Institute of Electrical and Electronics Engineers.
25. ISO: International Organization for Standardization.
26. ISP: Inside Cable Plant.
27. IDF: Intermediate Distribution Frame: Location of building distribution equipment room(s).
28. MDF: Main Distribution Frame: Location of campus wide central equipment room).
29. MCSD: Martin County School District (Owner).
30. Mbps: Megabits per second.
31. MH: Maintenance Hole.
32. MM: Multimode fiber optic cable.
33. NEC: National Electrical Code, NFPA 70.
34. NESC: National Electric Safety Code, C2-1997.
35. NEXT: Near End Cross Talk.

36. NFPA: National Fire Protection Association.
37. OSHA: Occupational Safety and Health Administration.
38. OSP: Outside Cable Plant.
39. OTDR: Optical Time Domain Reflectometer.
40. PSACR: Power Sum Attenuation to Crosstalk Ratio.
41. PSELFEXT: Power Sum Equal Level Far End Cross Talk.
42. PSFEXT: Power Sum Far End Crosstalk.
43. PSNEXT: Power Sum Near End Crosstalk.
44. PR: Pair.
45. RCDD®: Registered Communications Distribution Designer.
46. RFI: Radio Frequency Interference.
47. RH: Relative Humidity.
48. SM: Single Mode Fiber Optic Cable.
49. TBB: Telecommunication Bonding Backbone.
50. TBBIBC: Telecommunication Bonding Backbone Interconnecting Bonding Conductor.
51. TE: Telephone Equipment (Wall Mounted Equipment Rack).
52. TGB: Telecommunications Grounding Busbar.
53. TIA: Telecommunications Industry Association.
54. TMGB: Telecommunications Main Grounding Busbar.
55. UL: Underwriters Laboratory.
56. UPS: Uninterruptible Power Supply.
57. WAO: Work Area Outlet

F. ABBREVIATIONS
   1. dB: Decibel: sound level or channel attenuation.
   2. “, in, inch(es), ft, foot: us length.
   3. mm, cm, m or km: metric length
   4. W: Ohm(s): wire resistance.
   5. µ: wavelength (nm) Nanometer.

1.4 SUBMITTALS

A. Comply with Section 01 33 00 - Submittal Procedures.

B. Comply with Section 01 35 33 - Security Procedures for submittal of installer’s personnel information for security badging requirements.

C. Project Record Documents
   1. Submit one (1) mylar reproducible set of Project Record Drawings and one electronic set of Project Record Drawings in AutoCAD Release 10 or later edition “DWG” rewritable file extension format.
   2. Submit complete updated hard copy of project record drawings and specifications maintained on project site during construction.
   3. See specific communication sections for additional requirements.

D. Operation & Maintenance Manuals:

1. Prior to the Substantial Completion Inspection, complete Operation & Maintenance (O&M) Manuals.
2. Submit O&M Manuals to Owner at Substantial Completion Inspection.
3. Instruction manuals shall contain sufficient information to permit Owner's personnel to operate system without assistance from Contractor.
4. Provide O&M Manuals covering equipment and materials furnished.
5. O&M Manuals shall contain information necessary for operation, maintenance, parts procurement, and parts replacement for SCS.
6. Information shall include detailed documentation for firmware configuration.
7. Provide 8-1/2" x 11" loose leaf 3-ring binders with clear vinyl overlay designed to receive identification inserts with identification on front cover and back splines as follows:
    a. Operating & Maintenance Manual, Project Name, and Contractor.
    b. On front page, enclosed in 3-ring clear plastic sheet protector, provide the following:
    c. Project Name.
    d. Contractor Name.
    e. Contractor's Project Manager.
    f. Contractor's Project Number.
    g. Owner's Project Number or Purchase Order Number.
    h. Contact list with name, address, contact person, phone number, and fax number for each of the following:
    i. Structured Cabling System Contractor.
    j. Conduit subcontractor.
8. Manufacturers of Equipment and local supply source(s) for repair parts.
9. Index: On the second page, enclosed in a 3-ring clear plastic sheet protector, provide index indicating section numbers and titles.
10. Sections shall be separated with tabbed section divider with number and title (typed) as follows:
    a. Section 1 - Cuts Sheets: Manufacturer's original data/cut sheets for each system component.
    b. Section 2 - Equipment List: Typed list of each item of equipment with brief description, serial number, and part number, enclosed in 3-ring clear plastic sheet protector.
    c. Section 3 - Factory Manuals: Factory Manuals: Manufacturer's printed Installation and Operating Manuals for each item of LAN equipment. Provide 3-ring zip- lock pockets for each manual not factory 3-ring punched. Do not include manuals loose or inserted in binder pockets.
    d. Section 4 - Warranties: Copy of Contractor's warranty and Manufacturer's printed warranty for each item of equipment. Enclose in 3-ring clear plastic sheet protector.
    e. Section 5 - Transmittal of Loose Items: Copy of transmittal to Owner's Project Manager for loose items such as patch cords, wire management rings, spare parts, with receipts signed-off by Owner's Project Manager. Enclose in 3-ring clear plastic sheet protector.
    f. Section 6 - Documentation of Training: Documentation of training signed- off by Owner's Project Manage (insert in manuals at Final Completion inspection). Enclose in 3-ring clear plastic sheet protector.

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g. Section 7 - Cable Tests: Executive summary of test results for Category 6, fiber optic, ITV, and voice backbone cabling.

1.5 QUALITY ASSURANCE

A. Comply with Section 01 45 00 – Quality Control.

B. Telecommunications installer shall have RCDD (Registered Communications Distribution Designer) on staff with minimum of 3 years of experience with specified manufacturers' hardware and cabling.

C. Telecommunications installers shall have experience with installation of specified manufacturers' hardware and cabling.

D. Telecommunications installers shall use BICSI registered installers. Seventy-five percent or more of installers shall be BICSI Installer Level II. Up to twenty-five percent of installers may be BICSI Installer Level I. Workers not involved in installing cable elements (e.g., laborers delivering/moving materials, installing grounding by electrician, or workers installing pathway elements) do not have to be registered.

E. Team leads shall be BICSI registered technicians. Provide statements in bid documents of experience for proposed team leads. Statements shall include industry-specific training and certifications with dates verifying active status on registrations/certifications, project experience, experience with Category 6 and shielded cabling, and experience as a team lead.

F. Only installers trained and certified by manufacturer shall be allowed to install copper products. Installers shall possess highest levels of certification available by manufacturer for specific structured cable solution being installed.

G. Only installers trained and certified by fire stop manufacturer shall be allowed to install fire stop products. See Section 07 84 00 – Fire Stopping.

H. Only installers trained and certified for cable testing and wiring by manufacturer shall be allowed to terminate and test optical fiber. Other installers specified above may pull or place optical fiber cable under supervision of installer trained and certified by manufacturer. Submit proof of registration/certification of proposed installers to include narrative on levels of registration/certification of installers.

I. Owner reserves right to reject unregistered or uncertified installers performing work for which they are not certified. Installer shall be responsible for loss of work, delays in schedules, or extra cost from use of unregistered/uncertified workers. Additional cost and effort to maintain installation schedule shall be communications system installer's responsibility.

J. Provide required documentation for new workers after submittal of initial documentation on installers. Owner may periodically check installer identification and registrations/certifications during installation.

1.6 PROJECT CONDITIONS

A. Security and Work Coordination:

1. SCS construction area shall be protected and secured from unauthorized access.
2. Workplace safety and security is SCS installer's responsibility.
3. Contact Contractor/CM or Owner's Project Manager, if project has no Contractor/CM, of conditions preventing safe, timely or complete installation of telecommunications systems.
4. Failure to provide notification to Contractor/CM or Owner's Project Manager shall be deemed acceptance of working conditions.
5. Comply with Section 01 31 00 – Project Coordination. Access to project including SCS installer's approved parking and "lay-down areas", access to buildings, maintenance holes, handholes, hand boxes, utility poles, underground spaces, and pathways shall be coordinated with Owner's Project Manager.

6. Contractor/CM or SCS installer, if project has no Contractor/CM, shall provide traffic control and signage to maintain safe working environment.
7. Work area access, road closures, parking spaces closures, and work outside of Owner's normal operating hours shall be coordinated with Owner's Project Manager.
8. Owner's continued occupation of existing facilities shall not be interrupted by SCS installer's work activities.
9. Active cable plant associated with specific work and active cable plant beyond construction area shall not be disrupted.
10. Unusual circumstances (e.g., voice cutovers) may occur if prior written notification and approval is granted by Owner's Project Representative. Disruptions, if needed, shall be at Owner's convenience and approved schedule.

B. Owner shall not be responsible for delays or additional compensation due to SCS installer's unsafe working practices or unacceptable work.

1.7 WARRANTY

A. Communications Installer shall provide warranties or guarantees in accord with Section 01 78 00 – Closeout Submittals and as noted herein.

B. Communications CAT 6 and fiber optic cabling shall adhere to warranty requirements of Siemens System 6 Structured Cable System and shall be inclusive with manufacturer's and installer's warranties for complete and functional communications system.

C. Manufacturer and authorized communications installer shall provide twenty-five (25) year warranty for category 6 structured cabling system for end-to-end channel model installation covering applications assurance, margin compliance claimed by manufacturer over category 6 channel specifications for transmission parameters across entire frequency range of 1-250 MHz in accord with manufacturers catalogs and literature, cable, connecting hardware and labor cost for repair or replacement.

D. Manufacturer shall provide 20-year Channel Performance Warranty for complete communications system. System shall be Siemon Systems 6 Structured Cable System.

1. Manufacturer's shall warranty worst-case performance data for installed cabling system, and performance data indicated in warranty documents/certificate.
2. Twenty (20) year warranty for Cat 6 structured cabling system shall provide for end-to-end channel model installation which covers applications assurance, cable, connecting hardware, and labor cost for repair or replacement.

E. SCS installer shall provide 3-year warranty for communications system installation to include materials and labor warranty for replacement of defective installation or equipment including cables, jacks, patch cords, patch panels, devices, and cabling.

F. Date of warranty period shall begin from date of project's substantial completion and acceptance by Owner.

END OF SECTION

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SECTION 27 05 26 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Grounding and bonding for TMGB at entrance to main electrical room, and TGB for other network rooms, ISP, conductors, connections and required hardware.

B. Protection, grounding, and bonding shall be provided in new construction and in existing buildings where completely new communications system work is to be installed, or in existing buildings where expansion of existing communications system is required to interface with existing communication systems.

C. Upgrading of existing communication systems to current codes, including installation of lightning protection, grounding buss bars, and bonding backbones.

D. Coordination of interface connections with electrical contractor for proper pathway and termination locations, busbar locations and connection to main electrical service ground and electrical distribution panels.

1.2 REFERENCES

A. Telecommunications Definitions (See Section 01 42 00 – References for additional reference standards, definitions, abbreviations, and acronyms).

1. BCT (Bonding Conductor for Telecommunications): conductor that interconnects telecommunications bonding infrastructure to building’s service equipment (power) ground.
2. Bonding: Joining of metallic parts to form electrically conductive path.
3. GE (Grounding Equalizer): conductor interconnecting elements of telecommunications grounding infrastructure.
4. Ground: Conducting connection between electrical circuit or equipment and earth or to some conducting body that serves in lieu of earth.
5. RBC (Rack Bonding Conductor): Bonding conductor connecting equipment rack directly to TMGB or TMB.
6. RGB (Rack Grounding Busbar): Busbar vertically mounted on equipment rack.
7. TBB (Telecommunications Bonding Backbone): Conductor connecting telecommunications main grounding busbar (TMGB) to
8. TGB (Telecommunications Grounding Busbar): common point of connection for telecommunications system and equipment boding to ground and located in Telecommunications Room or Equipment Room.
9. TMGB (Telecommunications Main Grounding Busbar): Busbar placed in convenient and accessible location and bonded by bonding conductor for telecommunications and to building service (power) ground.
10. UBC (Unit Bonding Conductor): Conductor interconnecting Rack Bonding Busbar to telecommunications equipment.

B. NFPA 70 - National Electrical Code; National Fire Protection Association; 2020.

C. Soares Book on Grounding.

D. IEEE Standard 1100 – IEEE Recommended Practice for Powering and Grounding Electronic Equipment (Emerald Book).

E. Building Industry Consulting Services International (ANSI/NECA/BICSI):

1. BICSI–607 - Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings.

2. BICSI-607A – Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises.

1.3 QUALITY ASSURANCE

A. Comply with Section 01 45 00 – Quality Control.

B. Network equipment grounding shall be installed per ANIS-J-STD-607-A standard.

C. Voltage drop over grounding conductors shall not exceed 40 volts. Installer shall provide sizing calculations based on grounding electrode conductor to AE for review.

D. Protectors, grounding, and bonding hardware shall be products of same manufacturer.

E. Grounding conductors shall be sized for maximum current possible for electrical grounding electrode conductor to pass through telecommunications grounding system.

F. Sizing of Telecommunications Bonding Backbone (TBB) and Grounding Equalizer (GE):

1. TBB and GE shall be copper conductors (#6 AWG minimum size).
2. TBB and GE shall be sized at 2 kcmil per linear foot of conductivity length up to maximum of 3/0 AWG and may be insulated.
3. If insulated, TBB and GE shall meet fire ratings of its pathway and shall be listed for space in which it is located.
4. TBB and GE sizing noted in attached Schedule is not intended to account for reduction or control of electromagnetic interference.
5. Bonding and Grounding Conductor Sizing Schedule:

TBB OR GE LENGTH Meters (Ft)	TBB/GE Size (AWG)
< 4 (13)	6 (13mm²)
4-6 (14-20)	4 (21mm²)
6-8 (21-26)	3 (27mm²)
8-10 (27-33)	2 (34mm²)
10-13 (34-41)	1 (42mm²)
13-16 (42-52)	1/0 (54mm²)
16-20 (53-66)	2/0 (67mm²)
>20 (66)	3/0 (85mm²)

1.4 SUBMITTALS

A. Comply with Section 01 33 00 - Submittal Procedures.

B. Product Data: Submit manufacturer’s descriptive literature for each system component specified with specific product number clearly identified.

C. Shop Drawings:

1. Provide scaled drawings of floor plans (not less than 1/16” = 1’-0”) indicating proposed location and size, dimensions, type of connection (e.g., mechanical, exothermic weld of each bonding busbar (e.g., TMGB and TGB), conductor (e.g., BCT, GE and TBB), connections (e.g., lugs), and splice points.
2. Provide scaled plan and elevation drawings of Telecommunication Rooms (not less than 1/4” =1’-0”) indicating proposed locations busbars (e.g., TMGB, TGB, UBC and RGB).
3. Provide separate drawing for proposed bonding and grounding layouts and details.

D. Comply with Section 01 78 00 - Closeout Submittals for project closeout documents.

E. Project Record Documents:

1. Provide scaled drawings of floor plans (not less than 1/16" =1'-0") indicating actual location and size, dimensions, type of connection (e.g., mechanical, exothermic weld of each bonding busbar (e.g., TMGB and TGB), conductor (e.g., BCT, GE and TBB), connections (e.g., lugs), and splice points.
2. Provide scaled plan and elevation drawings of Telecommunication Rooms (not less than 1/4" =1'-0") indicating actual locations busbars (e.g., TMGB, TGB, UBC and RGB).
3. Provide separate drawing for actual bonding and grounding layouts and details.

F. Operation and Maintenance (O&M) Manuals:

1. Manufacturer's specification sheets (cutsheets), operation and maintenance manuals for each product and system maintenance.

G. Certification: Provide letter to Owner's Project Manager from Contractor/CM installer's RCDD that grounding system was installed in accord with contract documents, acknowledging that telecommunications grounding system has been successfully tested and is fully functional for intended purpose. One letter from RCDD may be submitted to include attesting requirements from other Div. 27 Sections.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Approved Manufacturer's.

1. Ortronics Corporation, 125 Eugene O'Neill Dr., New London, CT 06320; Tel: 1 887 599-5393; Fax: 1 888 282-0043: Website; www.ortronics.com.
2. Erico International Corp., 34600 Solon Rd., Solon, OH 44139. Tel: 440-248-0100; Fax: 440- 248-0723; Website: www.erico.com.
3. Chatsworth Products Inc., 701 Industrial Dr., New Bern, NC 28562. Tel: 252-514-2779; Fax: 252-514-2977; Website: www.chatsworth.com.
4. Thermoweld/Continental Industries, 4102 South 74th East Ave., Tulsa, OK 74145-4707. Tel: 918-627-5210; Fax: 918-622-1275; Website:www.conind.com.
5. Harger Group, 301 Ziegler Dr. Grayslake, IL 60030; Tel: 800-842-7437; Fax: 847-548-8755; Website: www.harger.com.
6. Panduit Corp., 18900 Panduit Dr., Tinley Park, IL 60478; Tel: 708-532-1800; Fax: 708-532-1811; Website: www.panduit.com.

B. Other manufacturers shall comply with Section 01 25 13 - Product Substitution Procedures for product approval.

2.2. TELECOMMUNICATIONS MAIN GROUNDING BUSBAR (TMGB):

A. Manufacturers:

1. Harger BICSI pattern 4" x 12" TMGB kit (#GBI1412JKT); 2" x 12" MGB kit (#GBI14210GKT).
2. Chatsworth BICSI pattern 4" x 12" TMGB kit, TMGB (40158-012): Chatsworth BICSI pattern 2" x 12" MGB kit, TGB (40156-012). 2, Rack-mount busbar:
   a. Ortronics Grounding Strip (OR-808004551)
   b. Chatsworth Horizontal Rack Busbar, 19" (10610-019).

2.3 TELECOMMUNICATIONS GROUNDING BUSBAR (TGB)

A. Manufacturers:

1. Harger BICSI pattern: 2" x 12" MGB kit (#GBI14210GKT).
2. Chatsworth BICSI pattern: 2" x 12" MGB kit, TGB (40156-012).

2.4 BONDING CONDUCTORS FOR TELECOMMUNICATIONS (BCT)

A. Bonding Conductor:
   1. Bare copper conductor, stranded.
   2. Insulated copper conductors, insulated, green, stranded or solid.
   3. Equal in size to largest Telecommunications Bonding Backbone (TBB).

B. Approved Manufacturers:
   1. Harger Group.
   2. Panduit Corp.

2.5 TELECOMMUNICATIONS BONDING BUSBAR (TBB)

A. TBB:
   1. Bare copper or insulated conductor.
   2. Conductor shall be listed for application when insulated.
   3. Conductor shall be sized at 2 kcmil per linear foot of conductor length up to maximum wire size of 3/0 AWG.

2.6 GROUNDING EQUILIZER (GE)

A. GE:
   1. Bare copper or insulated conductor.
   2. Conductor shall be listed for application when insulated.
   3. Conductor shall be same size as largest TBB.

B. Approved Manufacturers:
   1. Harger Group.
   2. Panduit Corp.

2.7 RACK BONDING CONDUCTOR (RBC)

A. RBC:
   1. Bare copper or insulated conductor.
   2. Conductor shall be listed for application when insulated.
   3. Conductor shall be minimum of same size as largest TBB.

B. Approved Manufacturers:
   1. Harger Group.
   2. Panduit Corp.

2.8 RACK BONDING BUSBAR (RBB)

A. RBB:
   1. Busbar shall be wrought copper and tin-plated grounding strip for use in 2-post and 4-post Communications Racks.
   2. Busbar shall support multiple unit bonding conductors and shall be UL listed.

B. Manufacturers:
   1. Harger Rack Grounding Busbar Kit #RGBVKIT14583672A.
   2. Panduit Rack Grounding Busbar Strip Kit #RGS134-1Y.

2.9 GENERAL BONDING CONDUCTORS OR JUMPERS

A. Provide and install general bonding conductors and jumpers as indicated.

B. Provide conductors and jumpers connecting equipment located in same rooms as TMGB/TMB, conductors and jumpers shall be in green insulated jacket. Jacket shall include markings that indicate conductor size (minimum of #6 AWG), manufacturer, and UL listing.

C. Approved Manufacturers:

1. Harger Group.
2. Panduit Corp.

2.10 BONDING ACCESSORIES

A. Exothermic weld connectors, UL listed:

1. Approved Manufacturers:
    a. Erico International; Cadweld products.
    b. Continental Industries; Thermowell products.

B. Grounding Lugs:

1. Two-lug connectors, UL-listed, irreversible compression.
2. Single-lug connectors, UL-listed, irreversible compression.
3. Approved Manufacturers:
    a. Enrico International Corp.
    b. Harger Group
    c. Panduit Corp.

C. Stand-off Insulators:

1. Round or hexagon glass reinforced thermoset polyester insulators sized for voltage rating.
2. Approved Manufacturers:
    a. Harger Group.
    b. Chatsworth Products, Inc.

D. Other materials as required for complete and functioning grounding system.

PART 3 - EXECUTION

3.1 GENERAL

A. Install 6-side fire-rated pre-painted (color: grey) plywood panel on interior room walls of Telecommunications Rooms with sufficient anchorage to walls to support items attached to walls.

B. Locate TMGB and TGBs per approved shop drawings and shall be easily accessible to telecommunications staff.

C. Follow manufacturer’s printed installation instructions. If manufacturer and contract documents are in conflict, most stringent shall apply. If manufacturer’s printed instructions are conflicting, immediately report discrepancies to A/E in timely manner to maintain project schedule.

3.2 TELECOMMUNICATIONS MAIN GROUNDING BUSBAR (TMGB)

A. TMGB Installation:

1. Position TMGB to be protected from physical damage.
2. Install TMGB with stand-off insulators.
3. If building TMGB is located in another room, install TGB with stand-off insulators.
4. TMGB shall be bonded to grounding conductor with exothermic weld.
5. Bond entrance facility busbar to appropriately sized TBB with exothermic weld.

6. Neatly install conductor from entrance facility busbar at right angles along walls or ceiling surfaces to structural steel within same room or room in close proximity to electrical service panel within room, or metallic cold-water pipes within room.
7. Conductors attached to structural steel shall be connected with exothermic welds.
8. Metallic raceways for telecommunications cabling in space where TMGB is located shall be bonded to the TMGB.
9. Insulate TMGB 2” from wall.
10. For outside plant cables entering building with cable shield isolation gap, bond cable shield (on building side of gap) to TMGB. Outside plant protectors shall be bonded to TMGB with #6 AWG copper conductors.
11. Connections to busbar shall be made with 2-hole lugs.
12. Connections shall be made by cleaning area of connection on busbar and 2-hole lugs and then applying thin coating of antioxidant compound.

3.3 COMMUNICATIONS GROUNDING BUSBAR (TGB)

A. TGB Installation:

1. Provide and install necessary grounding hardware to properly ground equipment in network room per codes, standards and methodologies noted. Self-tapping screws, or any other type of screws, shall not be used to form bonds or attach grounding hardware.
2. Within each network room, provide and install insulated (green), stranded #6 copper ground wire from network room busbar to following items:
    a. Racks
    b. Ladder rack
    c. BETs
    d. Electrical service panels- Provide and install two-lug connectors or exothermic bonds to busbar.
    e. Metallic, cold-water pipes- Verify identification of water pipe with Owner’s Project Manager prior to bonding to it. Provide and install two-lug connectors or exothermic bonds to busbar and provide and install appropriate grounding connectors for water pipes, if present.
    f. Metallic raceways for telecommunications cabling in space where TMGB is located shall be bonded to the TMGB.
    g. Insulate TMGB 2 inches from wall.
    h. Connections shall be made by cleaning area of connection on busbar and 2-hole lugs and then applying thin coating of antioxidant compound.
3. Do not bend grounding conductor wires into tight angles. Changes in direction shall be of the highest radius possible.

3.4 MAIN DISTRIBUTION FRAME ENCLOSURES (MDF)

A. MDF Installation:

1. Install 6-side fire-rated pre-painted (color: grey) plywood panel on interior room walls with sufficient anchorage to walls to support items attached to walls.
2. Install grounding busbar in enclosure housing networking or other active equipment. Install busbar at location indicated and approved by Owner’s Project Manager. Busbar may be rackmount busbar attached to rails or backboard.
3. Provide and install necessary grounding hardware to properly ground equipment in network room per applicable codes, standards and methodologies noted. Self- tapping

screws, or any other type of screws, shall not be used to form bonds or attach grounding hardware.

4. Connect enclosure to TBB with not more than 30 feet of insulated (green), stranded #6 copper ground wire.
5. Do not bend grounding conductor wires into tight angles. Changes in direction shall be of highest radius possible.

3.5 BONDING CONDUCTOR FOR TELECOMMUNICATIONS (BCT)

A. Route BCT in conduit from telecommunications service entrance room to main electrical service ground connection.
   1. See Section 27 05 53 – Identification for Communication Systems.
   2. Label conduit at telecommunications service entrance with tag or adhesive label that states, “Building Conductor for Telecommunications (BCT) to Main Electrical Service Ground Connection”.
   3. Label conduit at main electrical service ground with tag or adhesive label that states, “Building Conductor for Telecommunications (BCT) to Telecommunications Main Grounding Busbar”.
   4. BCT shall not be run in metallic conduit nor completely encircled with metallic clamps.

3.6 TELECOMMUNICATIONS BONDING BACKBONE (TBB)

A. TBB when located along same route as cable tray shall be located on outer side of cable tray to minimize contact with communications cabling.

3.7 BONDING CONDUCTORS OR JUMPERS

A. Bonding conductors or jumpers shall be utilized in each telecommunications room between TMGB/TGB and following components:
   1. Communications building entrance protectors.
   2. Electrical panel board (if in same room as TMGB/TGB).
   3. Building steel frame (if available in same room as TMGB/TGB).
   4. Telecommunications ladder rack and cable tray:
      a. Bonding jumpers may be utilized to ground adjacent pieces of ladder rack and cable tray together, reducing need for single conductor back to TMGB/TGB.
      b. Where ladder racks or cable trays are painted, paint shall be removed at connection points prior to making connections.
   5. Telecommunications equipment racks and cabinets:
      a. Cabinets and racks shall be bonded to TMGB/TGB directly with #6 AWG Rack Bonding Conductor (RBC) from Rack Grounding Busbar (RGB).
      b. Where ladder racks or cable trays are painted, paint shall be removed at connection points prior to making connections.

3.8 GROUNDING LUGS

A. Wires shall be inserted to full depth of lugs.

B. Space between wire insulation and body of compression lugs shall be not greater than 0.25” (63mm).

C. Lugs shall be sized to match wire size per lug manufacturer’s printed recommendations.

D. Lugs shall have manufacturer’s embossed coding system imprinted on lugs.

E. Connectors may not be modified. Daisy chaining and stacking (piggy backing) of ground lugs is prohibited.

F. Bolts, nuts, washers for securing connections shall match hole diameters.

3.9 TESTING

A. Comply with Section 27 18 00 - Communications Testing.

B. Telecommunication Grounding System Test Notification:

1. Grounding connections shall be tested for continuity and resistance after installation but prior to project substantial completion.

2. A/E, District Educational Technology Department, and Owner's Project Manager shall be given forty-eight (48) hours' notice prior to start of testing.

C. Telecommunication Grounding System Testing:

1. Testing shall be performed for impedance of bonds of grounding system, including cable armor bonding to ground. Impedance of two-point bonding test across any bond shall not exceed 0.1 ohm. Remediate bond(s) over limit or which contribute to total impedance exceeding 0.1 ohm from any point in network room to busbar in that room.

2. Bonds installed shall be tested for impedance with earth ground resistance test in its two-point setup (LEM Handy GEO tester, or approved tester). Place QA label (with date and inspector) in proximity to each bond tested.

3. Test grounding conductors, once installed, for current. Measure AC and bi- directional DC current. Report AC current over 1 Amp. Report any DC current, in either direction, over 500 milliamps.

END OF SECTION

SECTION 27 05 28 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Surface metallic raceways, surface nonmetallic raceways, fittings, device and cover brackets, utility columns, outlet boxes, poke-thru floor boxes, pull and junction boxes for communications systems.

1.2 REFERENCES

A. See Section 01 42 00 – References for additional reference standards, definitions, abbreviations, and acronyms.

B. National Fire Protection Association (NFPA): NFPA 70 - National Electrical Code; 2020.

C. National Electrical Manufacturers Association (NEMA):

1. NEMA WD 6 - Wiring Devices - Dimensional Requirements, 2021 Edition.
2. NEMA VE 1 - Metallic Cable Tray System; National Electrical Manufacturers Association; 2017 Edition.

D. Telecommunications/Electronics Industry Association (TIA/EIA): TIA/EIA-569 - Commercial Building Standard for Telecommunications Pathways and Spaces; Rev. E, 2019, and relevant Addenda (ANSI/TIA/EIA-569).

E. Underwriters Laboratories (UL): UL 5 - Surface Metal Raceways and Fittings; Underwriters Laboratories Inc; 2022.

F. National Electrical Contractors Association (NECA): NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2023.

G. National Electrical Manufacturers Association (NEMA):

1. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; National Electrical Manufacturers Association; 2013.
2. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; National Electrical Manufacturers Association; 2013.

1.3 QUALITY ASSURANCE

A. Comply with Section 01 45 00 Quality Control. Comply with Reference Standards indicated.

B. Provide products listed and classified by Underwriters Laboratories, Inc., as suitable for purpose specified and indicated.

1.4 SUBMITTALS

A. Comply with Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer’s descriptive literature for each system component specified in this section.

C. Shop Drawings:

1. Submit raceway layouts, each system component required for complete system, raceway lengths, device types, locations and identify circuits.
2. Indicate cable tray type, dimensions, support points, and finishes.
3. Indicate box, outlets, systems furniture, and service pole locations.
4. Provide manufacturer’s catalog data for fastening systems.

D. Comply with Section 01 78 00 – Closeout Submittals: If variations from approved shop drawings occur during installation of raceway system, submit final as-built drawings indicating such variations.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with Section 01 66 00 – Product Storage and Handling Requirements.

B. Store products in manufacturer's unopened packaging until installation.

C. Maintain storage area conditions for products in accord with manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURES

A. Approved manufacturers are listed herein. Other manufacturers may submit for approval per Section 01 25 13 – Product Substitution Procedures.

2.2 SURFACE METALLIC RACEWAYS

A. Surface Metallic Raceways:

1. Acceptable product: Wiremold 4000 System by The Wiremold Company, 60 Woodlawn St., West Hartford, CT 06110. Tel: 800-621-0049, 860-233-6251; Fax: 860-232-2062; Website: www.wiremold.com.
2. Product description: Two-piece system of galvanized steel, nominal 0.040" (1.27 mm) metal thickness, having total assembled cross-section dimension 4.75" (120 mm) high by 1.75" (44 mm) deep, having cross-section area 7.5 square inches (48.38 sq cm), consisting of base, snap-on cover, and removable longitudinal barrier, dividing raceway interior into two equal spaces.
3. Surface-mount locations shall use shallow, wall-mount boxes with outlets on the sides of box.
4. Finish: ScuffCoat grey, white, or ivory color as selected.

B. Fittings:

1. Factory-formed units to complete indicated configuration of raceway systems, including external corner units, internal corner units, flat units, blank end units, and elbows.
2. Couplings: one per raceway unit.
3. Wire clips: One per two-foot intervals (61 cm) of indicated raceway configuration.
4. Replacement longitudinal barrier: One section per 8 linear feet (2.44 m) of indicated raceway configuration.
5. Material: Same material and metal thickness as linear raceway components.
6. Finish: Matching linear raceway components.

C. Device Brackets and Plates:

1. Factory-formed brackets and plates allowing installation of indicated power, data, and communications devices, both single-gang and two-gang, either vertically or horizontally in raceways.
2. Finish: Color matching linear raceway components.

2.3 SURFACE NONMETALLIC RACEWAY SYSTEMS

A. Surface Nonmetallic Multi-Channel Raceway System

1. Approved Product: Panduit LD10 Surface Raceway System, color: White
2. Corner Units:
   a. Supply factory-formed cover and trim cover units for internal and external corners of indicated raceway layouts.
   b. Finish corner units to match linear cover and trim cover units.
   c. Use all accessories as specified by the manufacturer for this line of products.

3. Fittings:
    a. Provide factory-formed fittings in rigid PVC compound with base to eliminate mitering for indicated configurations and service requirements.
    b. Finish: White.
    c. Use all accessories as specified by the manufacturer for this line of products.

2.4 INDOOR SERVICE POLES AND COMPONENTS

A. Approved Product: Wiremold Tele-Power Pole Multi Outlet Assembly by The Wiremold Company, 60 Woodlawn St., West Hartford, CT 06110. Tel: 800-621-0049, 860-233-6251; Fax: 860-232-2062; Website: www.wiremold.com.

B. Main Body: Aluminum with clear anodized finish in single unit lengths as required.

C. Cover Plates: Match pole finish.

D. Convenience Receptacle Configuration: NEMA WD 6; Type 5-20r. Furnish 4 per column.

E. Foot: Suitable for floor finish as indicated.

F. Provide concealed top clamp to fasten pole to inverted “T” grid ceiling suspensions member.

G. Accessories:
    1. Trim plates for closing ceiling opening to match poles.
    2. Flexible cable assembly with connector for branch circuit connections.

H. Fabrication:
    1. Provide full-sized opening at top of pole.

2.5 BOXES

A. Manufacture: The Wiremold Company: 60 Woodlawn St., West Hartford, CT 06110. Tel: 800-621-0049, 860-233-6251; Fax: 860-232-2062; Website: www.wiremold.com.

B. Outlet Boxes.
    1. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
    2. Nonmetallic Outlet Boxes: NEMA OS 2.

C. Poke-thrus.
    1. Two 20A duplex receptacles and up to four communications devices:
        a. Wiremold RC4 Flush Poke-Thru
    2. One 20A duplex receptacle and up to two communication devices
        a. Wiremold RC7 Flush Poke-Thru
    3. No other products are acceptable.

D. Floor Boxes.
    1. Wiremold AC Series Raised Floor Boxes.
    2. Wiremold 880 Floor Boxes for Wood Floors.

E. Pull Boxes and Junction Boxes.
    1. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verification of Conditions: Verify that substrates are prepared and ready to receive products specified.

3.2 SURFACE RACEWAY INSTALLATION

A. Surface raceway shall only be used if retrofit installations, all new construction builds shall not use surface mount raceways.

B. Raceway shall be mounted in unobtrusive manner. Horizontal raceway shall be used at baseboard elevation, under or over chair rails, or along ceiling.

C. Where possible, raceway shall extend vertically up or down from WAO. Installer shall discuss placement of raceway prior to installation with Owner's Project Manager.

D. Secure surface-mount raceway with screws. Do not use adhesive attachments.

3.3 COMMUNICATION SYSTEM FURNITURE POLES

A. Install utility columns plumb and fasten support to structure.

B. Use pre-manufactured knockouts for work area outlets. WAOs shall be installed flush or with minimal profile. Surface-mount boxes shall not be used on utility poles.

C. Neatly cut openings in ceiling panels and install trim plates.

3.4 BOX INSTALLATION

A. Install boxes securely, in neat and workmanlike manner, per NECA 1.

B. Install in locations indicated, and as required for splices, taps, wire pulling, equipment connections, and as required by NFPA 70.

C. Set wall mounted boxes at elevations to accommodate mounting heights at 18" (45.72cm) above finished floor, unless otherwise noted.

D. Boxes indicated on Drawings are approximate locations unless dimensioned.

E. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

F. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6" (15.24 cm) from ceiling access panel or from removable recessed luminaire.

G. Install boxes to preserve fire resistance rating of building elements, using materials and methods specified in Section 07 84 00.

H. Work area outlet boxes on opposite sides of a fire-rated wall shall not share the same stud space.

I. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.

J. Use flush mounting outlet box in finished areas.

K. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

L. Do not install flush mounting box back-to-back in walls; provide minimum 6 inches (mm) separation. Provide minimum 24" (60cm) separation in acoustic rated walls.

M. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

N. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

O. Do not fasten boxes to ceiling support wires.

P. Support boxes independently of conduit.

Q. Use gang box where more than one device is mounted together. Do not use sectional box.

R. Do not install work area outlets in standard AC outlet shaped openings within floor boxes.

S. Set floor boxes level.

T. Large Pull Boxes: Use enclosure with removable cover in interior dry locations, surface-mounted cast metal box in other locations. Hinged lids may be used, if provided with a means to

fasten securely open.Large Pull Boxes: Use enclosure with removable cover in interior dry locations, surface- mounted cast metal box in other locations. Hinged lids may be used, provided with a means to fasten securely open.

3.5 ADJUSTING

A. Adjust floor boxes and poke-thru flush with finish flooring material.

3.6 CLEANING

A. Remove dust, debris, and other material from product installation.

B. Clean exposed surfaces and restore finishes.

END OF SECTION

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SECTION 27 05 29 - HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Hangers and supports, wire baskets, cable trays and accessories for communications systems.

1.2 REFERENCES

A. See Section 01 42 00 – References for additional reference standards, definitions, abbreviations, and acronyms.

B. National Fire Protection Association (NFPA): NFPA 70 - National Electrical Code; National Fire Protection Association; 2020.

C. National Electrical Manufacturers Association (NEMA):

1. NEMA WD 6 - Wiring Devices - Dimensional Requirements, 2021 Edition.
2. NEMA VE 1 - Metallic Cable Tray System; National Electrical Manufacturers Association; 2017 Edition.

D. Telecommunications/ Electronics Industry Association (TIA/EIA): TIA/EIA-569 - Commercial Building Standard for Telecommunications Pathways and Spaces; Rev. A, 2019, and relevant Addenda (ANSI/TIA/EIA-569).

E. Underwriters Laboratories (UL): UL 5 - Surface Metal Raceways and Fittings; Underwriters Laboratories Inc; 2022.

F. National Electrical Contractors Association (NECA): NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2023.

G. National Electrical Manufacturers Association (NEMA):

1. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; National Electrical Manufacturers Association; 2013.
2. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; National Electrical Manufacturers Association; 2013.

1.3 QUALITY ASSURANCE

A. Comply with Section 01 45 00 Quality Control.

B. Provide products listed and classified by Underwriters Laboratories, Inc., as suitable for purpose specified and indicated.

C. Provide hanger and support sizes based on numbers and types of wire indicated plus 20% extra capacity for future growth.

1.4 SUBMITTALS

A. Comply with Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer’s descriptive literature for each system component specified in this section.

C. Shop Drawings:

1. Submit raceway layouts, each system component required for complete system, raceway lengths, device types, locations and identify circuits.
2. Indicate cable tray type, dimensions, support points, and finishes.
3. Indicate box, outlets, systems furniture, and service pole locations.
4. Provide manufacturer’s catalog data for fastening systems.

D. Comply with Section 01 78 00 – Closeout Submittals: If variations from approved shop drawings occur during installation of hanger and support system, submit final as-built drawings indicating such variations.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with Section 01 66 00 – Product Storage and Handling Requirements.

B. Store products in manufacturer's unopened packaging until installation.

C. Maintain storage area conditions for products in accord with manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURES

A. Approved manufacturers are listed herein. Other manufacturers may submit for approval per Section 01 25 13 – Product Substitution Procedures.

2.2 HANGARS AND SUPPORTS

A. Approved Cable Support Manufacturer: Vent.com:

1. CableCat Adjustable Cable Support (CAT425 series slings).
2. CableCat Cable Support (CAT64 series).

B. Hangers, Supports, Anchors, and Fasteners - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.

C. Anchors and Fasteners:

1. Obtain permission from Owner's Project Manager before using powder-actuated anchors.
2. Concrete Structural Elements: Use precast inserts, expansion anchors, powder- actuated anchors, or preset inserts.
3. Steel Structural Elements: Use Nvent beam clamps, steel spring clips, steel ramset fasteners, or welded fasteners.
4. Concrete Surfaces: Use self-drilling anchors or expansion anchors.
5. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts or hollow wall fasteners.
6. Solid Masonry Walls: Use expansion anchors or preset inserts.
7. Sheet Metal: Use sheet metal screws.
8. Wood Elements: Use wood screws.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verification of Conditions: Verify that substrates are prepared and ready to receive products specified.

B. Install hangars, supports and components in accordance with Drawings, Shop Drawings and manufacturer's printed installation instructions.

3.2 HANGARS AND SUPPORT

A. Attachment Devices:

1. Obtain Owner's Project Manager's permission before using powder-actuated anchors.
2. Concrete Structural Elements: Use precast inserts, expansion anchors, powder- actuated anchors, or preset inserts.
3. Steel Structural Elements: Use Nvent beam clamps, steel spring clips, steel ramset fasteners, or welded fasteners.
4. Concrete Surfaces: Use self-drilling anchors or expansion anchors.
5. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts or hollow wall fasteners.

6. Solid Masonry Walls: Use expansion anchors or preset inserts.
7. Sheet Metal: Use sheet metal screws.
8. Wood Elements: Use stainless steel wood screws.

B. Install cable supports above concealed ceilings using rigid support to structural element or by attaching directly to structural element.

C. Install hangers and supports as required to support electrical system components adequately and securely, in neat and workmanlike manner, per NECA 1.

1. Do not fasten support to pipes, ducts, mechanical equipment, or conduit.
2. Installer may use existing threaded rods for other utilities, if pre-approved by Owner's Project Manager and is capable of supporting additional load and maintaining clearances.
3. Do not drill or cut structural members.
4. Installation of hangars and supports to suspended ceiling grid support system in not allowed.

D. J-hooks or sling-type supports may be installed with suspended ceiling grid wire with manufacturer clamps, provided:

1. Wire is painted orange prior to installation, to differentiate from ceiling grid support wires.
2. Wire is not used to support ceiling grid, as required by the NEC.

E. Weld support members or use hexagon-head bolted fasteners to present neat appearance with adequate strength and rigidity. Use spring lock washers under nuts.

F. Support Category 6 cables with J-hook type or sling-type supports in concealed ceiling spaces.

G. J-hook and sling-type supports shall be installed every 4-5' (1.2-1.5m) on center for runs exceeding 30' (9.12m). Runs from main or secondary corridors into classrooms and offices require support.

H. Close J-hook supports with manufacturer provided bars and not with cable ties. Do not use cable ties to strap cable to J-hook supports. Install cables under such strain as to require tying to supports.

3.3 CLEANING

A. Clean cable trays and supports of dust and debris.

B. Clean exposed surfaces and restore finish.

END OF SECTION

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SECTION 27 05 36 - CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Labor, supervision, materials, equipment, and services for fully functional cable runway support system to include ladder and wire mesh cable trays, hangers, supports, and accessories for fully functional cable support system.

1.2 REFERENCES

A. See Section 01 42 00 - References for additional reference standards, definitions, abbreviations, and acronyms.

B. National fire Protection Association (NFPA):

1. NFPA 70, 2020 Edition, National Electrical Code.
2. NFPA 70B, 2020 Edition, Recommended Practice of Electrical Equipment Maintenance.

C. American National Standards Institute (ANSI):

1. TIA/EIA-568A - Commercial Building Telecommunications Cabling Standard.
2. TIA/EIA-569 - Commercial Building Standard for Telecommunications Pathways and Spaces; Rev. A, 2019, and relevant Addenda (ANSI/TIA/EIA-569).
3. TIA/EIA-606-A – Administration Standard for Telecommunications Infrastructure of Commercial Buildings, 2021.
4. TIA/EIA-607-A – Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, 2024.

D. National Electrical Manufacturer’s Association (NEMA):

1 NEMA VE 1 - Metallic Cable Tray Systems, 2013.

2 NEMA VE 2 - Metallic Cable Tray Installation Guidelines.

E. Building Industry Consulting Industry, Inc. (BICSI): Telecommunications Distribution Methods Manual, 15th Edition, 2024.

F. American Standards and Testing Materials (ASTM):

1. ASTM F593-01: Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
2. ASTM F594-09e1: Standard Specification for Stainless Steel Nuts.

1.3 QUALITY ASSURANCE

A. Comply with Section 01 45 00 - Quality Control. Comply with Reference Standards indicated.

B. Products listed shall be classified by Underwriters Laboratories, Inc. (UL), as suitable for purpose specified and indicated.

C. Cable trays, supports and related accessories shall be new, defect free, and from single manufacturer.

1.4 DESIGN CRITERIA

A. Provide ladder and wire cable tray sizes based on numbers and types of wire indicated plus 20% extra capacity for future growth.

B. Cable trays and supports shall be designed by SCS installer’s Registered Communications Distribution Designer (RCDD), based on cable loading, size and length of ladder or wire units, and support elements, and submitted as part of Shop Drawing submittals.

1.5 SUBMITTALS

A. Comply with Section 01 33 00 - Submittal Procedures.

B. Product Data: Submit manufacturer's descriptive literature for each cable tray system, tray support and attachment components, and accessories specified or indicated.

C. Shop Drawings:

1 Submit runway layouts for each cable tray type and location, dimensions, support points, and finishes.

2 Cable tray layouts, floor plans and sections shall be drawn to scale and shall include:

a. Relationships between components and adjacent structural, electrical, and mechanical elements.

b. Vertical and horizontal offsets and transitions.

c. Clearances for access above and to side of cable trays.

d. Vertical elevations of cable trays above floor or below bottom of ceiling structure.

3 Provide manufacturer's catalog data for fastening systems.

D. Submit manufacturer's printed installation instructions for installation, including product storage, protection, and handling requirements.

E. Comply with Section 01 78 00 - Closeout Submittals: If variations from approved shop drawings occur during installation of raceway system, submit Project Record Documents indicating system installed based on final locations.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with Section 01 66 00 - Product Storage and Handling Requirements.

B. Deliver and store cable trays, racks and accessories products in manufacturer's unopened packaging in clean dry area, protected from weather and construction traffic until installation.

C. Maintain storage area conditions for products in accordance with manufacturer's printed instructions.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURES

A. Chatsworth Products Inc., 701 Industrial Dr., New Bern, NC 28562. Tel: 252-514-2779; Fax: 252-514-2977; Website: www.chatsworth.com.

B. Cooper B-Line - USA, Division of Cooper Industries, PLC, 509 West Monroe St., Highland, IL 62249; Tel: 800-851-7415; Fax: 800-356-1438; Website: www.cooperindustries.com.

C. Cablofil, Division of Legrand, 8319 State Route 4, Mascoutah, IL 62258; Tele: 618-566- 3230; Fax:618-566-3250; Website: www.legrand.us/cablofil.com.

D. Other manufacturers may submit for approval of products per Section 01 25 13 - Product Substitution Procedures.

2.2 WIRE BASKET CABLE TRAY

A. Approved Products:

1. Cablofil Cable Tray EZ by Legrand.
2. Eaton B-Line.

2.3 LADDER CABLE TRAYS

A. Approved Products:

1. TELCO-STYLE cable runway by Chatsworth Products, Inc.
2. REDI-RAIL™ ladder cable tray by Eaton.
3. ITRAY ladder cable tray by Legrand/Cablofil.

2.4 ACCESSORIES

A. Fittings: Tees, crosses, risers, elbows, and other required fittings or as indicated shall be same material and finish as cable tray.

B. Cable tray supports and connectors, including bonding jumpers, shall be as recommended by manufacturer.

2.5 WARNING SIGNS

A. Lettering: 1.5 inches high, black letters on yellow background with words, “Warning! Not to Be Used as Walkway, Ladder, or Support for Ladders or Personnel”.

B. Comply with fastener requirements in Section 27 05 53, “Identification for Communications Systems”.

PART 3 - EXECUTION

3.1 CABLE TRAY INSTALLATION

A. Verification of Conditions: Verify that substrates are prepared and ready to receive products specified.

B. Install components of raceway systems per NEMA VE 1 and in accordance with Drawings, Shop Drawings, and manufacturer’s printed installation instructions.

C. Install cable trays securely, in neat and workmanlike manner, level with floors and ceilings, plumb and aligned with adjacent walls.

D. Install trays as complete system, including fastener, hold-down clips, support systems, barrier strips, adjustable horizontal and vertical splice plates, elbows, reducers, tees, crosses, cable dropouts, adapters, and bonding.

E. Install cable trays to be accessible for cable installation and splices are accessible for inspection and adjustment with following clearances:

1. 12 inches of unobstructed clearance above cable tray’s highest plane
2. 6 inches from source of EMI.
3. 12 inches from heat source exceeding 104-degrees F.

F. Cut cable trays using manufacturer’s equipment, or as recommended by manufacturer. Smooth rough or jagged edges and points.

G. If cables rise to ceiling space of floor above network room greater than 10’ (3.05m), install cable tray to relieve vertical weight from cables on each floor. Secure cables with Velcro-type straps as needed to relieve vertical weight strain.

H. Continuous support elements shall be bonded from ground to TMGB/TGB with grounding wire. Sections may be bolted together or tied together with grounding jumpers if support structure is approved by manufacturer as a grounding conductor.

I. Provide pull strings in cable trays.

J. Provide fittings or gaps with bonding jumpers to accommodate expansion and deflection where cable tray crosses expansion joints.

K. Cable tray can penetrate fire-rated barriers utilizing approved cable tray firewall penetration sleeve product.

L. If cable tray firewall penetration sleeve not used, use at least 2- 4” conduits or as required for cable volume in lieu of cable tray where installation passes through rated walls. Install one additional capped metal sleeve for future cable through firestop-sealed cable tray penetration of fire and smoke barriers.

M. Cable tray connections or changes in direction and elevation shall use manufacturer’s recommended fittings.

N. Different low voltage systems such as security, fire, communications, and data shall not share conduits, pathways, or cable trays.

O. Install permanent covers on vertical tray runs in accord with NFPA 70, after installing cable. Install cover clamps per NEMA VE 2.

P. Install warning signs in visible locations on or above cable trays after cable installation as noted in Para. 2.05. Signs shall be located not more than 33’ (10.06m) along length of cable trays, but not less than one per space.

Q. Wire baskets shall be single tiered wire baskets installed to allow 12” (30.4cm) of open space above and to accessible side of tray. Cable tray shall be 2” (5.1cm) deep wire basket tray with appropriate width dimensions as required by volume of cable planned for installation at time of construction, and account for 20 percent future growth.

R. Ladder rack style cable trays shall extend up to MDF and IDF room walls to provide access to racks and walls in “T” design. IDF rooms may use single, straight cable tray in line with rack, provided it extends parallel to face of rack.

S. Install ladder rack style cable tray products within network rooms for vertical strain relief as needed while maintaining 20 per cent additional capacity within support structure. Secure cables with Velcro-type straps at minimum of 36” (91.44cm), or as recommended by manufacturer to relieve vertical weight strain.

T. Do not use wire basket style cable trays in MDF or IDF rooms.

3.2 HANGARS AND SUPPORT DEVICES INSTALLATION

A. Support Devices.

1. Obtain Owner’s project Manager’s permission before using powder-actuated anchors.
2. Concrete Structural Elements: Use precast inserts, expansion anchors, powder-actuated anchors, or preset inserts.
3. Steel Structural Elements: Use beam clamps, steel spring clips, steel ramset fasteners, or welded fasteners.
4. Concrete Surfaces: Use self-drilling anchors or expansion anchors.
5. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts or hollow wall fasteners.
6. Solid Masonry Walls: Use expansion anchors or preset inserts.
7. Sheet Metal: Use sheet metal screws.
8. Weld support members or use hexagon-head bolted fasteners to present neat appearance with adequate strength and rigidity. Use spring lock washers under nuts.

B. Use appropriate hardware and parts to attach tray to permanent building structure (concrete columns or deck, structural steel, or other immovable structures capable of supporting cable tray). Parts shall be specifically designed and where possible UL-listed for final installed configuration:

1. Comply with Section 26 05 29 – Hangars and Supports for Electrical Systems.
2. Construct supports from channel members, threaded rods, or other appurtenances furnished by cable tray manufacturer.
3. Arrange supports in trapeze or wall-bracket form as required by location.
4. Place supports not to exceed maximum spans recommended by manufacturer.
5. Utilize splice plates to allow full rated loads at mid span.
6. Fasten cable tray supports to building structure. Arrange supports to prevent racking, twisting or misalignment from eccentric loading.
7. Do not install more than one cable tray splice between supports.

8. Make connections to equipment with flanged fittings fastened to cable trays and to equipment.
9. Do not support cable tray on equipment enclosures. Support trays independent of fittings
10. Cable tray elements shall be supported with manufacturer's hardware to provide minimal profile. Suspension shoes and brackets shall be used in place of trapeze struts. Sharp corners and threaded rod shall not extend below the basket.

C. Install hangers and supports as required to support communications system components adequately and securely, in neat and workmanlike manner, per NECA 1
   1. Do not fasten support to pipes, ducts, mechanical equipment, or conduit.
   2. Installer may use existing threaded rods for other utilities, if pre-approved by Owner's Project Manager and is capable of supporting additional load and maintaining clearances.
   3. Do not drill or cut structural members.
   4. Installation of hangars and supports to suspended ceiling grid support system is not allowed.

D. J-hooks or sling-type supports shall be installed with wire from structure above from trays in corridors through one penetration in wall adjacent to each space being supplied with data and communications outlets.
   1. Mount cables and supports at right angles from corridor to each space with manufacturer's clamps.
   2. Wire shall be painted orange prior to installation, to differentiate from ceiling grid support wires.
   3. Wire shall not be used to support ceiling grid, as required by NFPA 70.

E. Support Category 6 cables with Cat 6 rated "J" hooks with wide base if supporting more than eight cables.

F. J-hook and sling-type supports shall be installed every 4-5 feet on center for runs exceeding 30 feet. Runs from main or secondary corridors into classrooms and offices do not require support.

G. Close J-hook supports with manufacturer who provided bars and not with cable ties. Do not use cable ties to strap cable to J-hook supports. Install cables under such strain as to require tying to supports.

3.3 CLEANING

A. Clean interior of cable trays, boxes to remove dust, debris, and other material.

B. Clean exposed surfaces and restore finish.

END OF SECTION

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SECTION 27 05 53 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Identification and labeling of system communication components including locations of each element of system and labeling of each component.

B. Cables and terminations shall be identified in accord with TIA/EIA 606 for labeling and numbering with cables terminated in alpha-numeric sequence at both origination and termination locations.

1.2 REFERENCES

A. See Section 01 42 00 - References for additional reference standards, abbreviations, definitions, and acronyms.

B. National Electric Code (NEC) 2020 Edition.

C. Telecommunications Industry Association (TIA)/Electronics Industry Association (EIA):

1. TIA/EIA-606-A - Administrative Standard for Commercial Telecommunications Infrastructure.

2. TIA-942 - Telecommunications Infrastructure Standard for Data Centers.

D. Building Industry Consulting Services International (BICSI):

1. Telecommunications Distribution Methods Manual (TDMM).

2. Information Transport Systems Installation Methods Manual (ITSIMM).

E. NFPA 70E, 2020 Edition - Standard for Electrical Safety in the Workplace.

1.3 QUALITY ASSURANCE

A. Labeling shall be printed on patch panel and faceplate manufacturer approved products, printed to produce, crisp, clear, non- smearing, and legible labels.

B. Labels shall be durable for life of telecommunications system.

C. Telecommunication system warranty shall include 20-year labeling replacement due to illegible or detached labels.

D. No hand-written labels permitted.

1.4 SUBMITTALS

A. Comply with Section 01 33 00 - Submittal Procedures.

B. Product Submittals:

1. Provide manufacturer’s product information cut sheets and specifications with specific product number identified or filled out.

2. Provide labeling lists for outlets, horizontal cables, and backbone cabling in Microsoft Excel format for planned identification labels in accordance with current District (Owner) labeling standards.

3. Labeling lists shall be approved by Owner’s Project Manager prior to start of communications installation.

C. Shop Drawings:

1. Provide scaled drawings of floor plans indicating outlets with proposed identification label for each outlet. Each cable shall be terminated in alpha- numeric sequence at termination locations as specified in this section.

2. Provide riser diagrams for each Communications Room identified by FISH Room Number and backbone cable(s) by both room number and cable number.

3. Provide enlarged scaled drawings of each Communications Room indicating Rack Row and Number(s), with patch panel locations and number(s).
4. See Part 3 – Execution for additional instructions for labeling of racks and patch panels.

D. Project Record Documents:

1. See Section 01 78 00 – Closeout Submittals. See other specification sections for specific record document requirements for those sections.
2. Field deviations, changes, and additions of telecommunications system from reviewed Shop Drawings shall be recorded on project field documents during construction and submitted to AE for review and compilation of final Record Documents (drawings, project manual, and cable manifest) which shall be submittal to Owner as part of final project closeout.
3. Cable manifest (spreadsheet in Microsoft Excel format) shall identify source, destination, pair/strand count, and labeling scheme used for each horizontal and backbone cable.
4. Project Record Documents shall only include Division 27 work scope and shall be submitted on one USB Flash Drive. See Section 01 78 00 – Closeout Submittals for required number of copies.

1.5 PROJECT REQUIREMENTS - LABELING

A. Conduits that provide access to MDF or IDF shall be labeled with same identifier at both ends.

1. Label conduit as “COMMUNICATIONS” (unless otherwise noted) with text readable from standing position on finished floor.
2. For wall stub-up locations, for future use, label end of stub-up conduit in Telecommunications (MDF and IDF) Rooms only.
3. For overhead conduits, label both ends in Telecommunications (MDF and IDF) Rooms.
4. For long runs of conduit that stub-up into Telecommunications (MDF and IDF) Rooms, label end of conduits in Telecommunications (MDF and IDF) Rooms with destination room name and number or locations without space numbers such as elevators.
5. Sleeves passing through single wall or floor do not have to be labeled, unless walls are fire rated.

B. Junction Boxes and Pull Boxes:

1. Label exterior of junction boxes and pull boxes as “COMMUNICATIONS” with text readable from standing position on finished floor.

C. Voice patch panels shall be labeled at both ends to indicate where it is served from/to.

1. Each voice copper cable is to be identified with a cable-wrap style printed label following the same nomenclature as front of patch panel.
2. For example, a 25-pair voice patch panel from building 1 room 191 to building 4 room 294 shall be labeled: 25p.001-191.004-294.

D. Grounding and bonding system shall be labeled in accord with TIA/EIA-606.

E. Fiber Patch Panels

1. MDF and IDF rooms shall have separate fiber enclosures for Single Mode and Multimode optical fiber cable.
2. Each fiber optic cable is to be identified with a cable-wrap style printed label following the same nomenclature as front of fiber enclosure.
3. Each fiber enclosure shall be labeled using manufacturer built-in labeling system. For example, a multimode 12-strand cable from building 1 room 191 to building 4 room 294 shall be labeled: MMFO12.001-191.004-294.

F. Category 6 Copper Patch Panels

1. Each inbound horizontal cable is to be identified with a cable-wrap style printed label following the same nomenclature as front of patch panel. Channel color can be typed rather than background-printed (type “Red” instead of printing a red background on label).
2. Each port in copper patch panel shall be labeled with Siemon Z-PNL-PS holder and Z-PNL-PL48 labels with room number where cable is terminated at the WAO followed by the drop identifier for that room. The label for each channel is to have the color of the channel printed onto the label to identify the channel on both ends. The color is to match the icon color at the WAO.
3. For example, a port that supplies a WAO in room 106 drop “A” channel red would be: “106.A” on the label with the background color of the label printed red. Do not use the preprinted/prenumbered side of the Z-PNL-PL48 label sheet.

G. Wireless Access Point Copper Patch Panel

1. Wireless access points shall be terminated in separate patch panel from other horizontal cables. Patch panel shall be labeled “WAP”.
2. Each inbound horizontal cable is to be identified with a cable-wrap style printed label following the same nomenclature as front of patch panel. Channel color can be typed rather than background-printed (type “Red” instead of printing a red background on label).
3. Each port in copper patch panel shall be labeled with Siemon Z-PNL-PS holder and Z-PNL-PL48 labels with room number where cable is terminated at the WAO followed by the drop identifier for that room. The label for each channel is to have the color of the channel printed onto the label to identify the channel on both ends. The color is to match the icon color at the WAO.
4. For example, a port that supplies a WAP WAO in room 106 drop “WAP1” channel red would be: “106.WAP1” on the label with the background color of the label printed red. Do not use the preprinted/prenumbered side of the Z-PNL-PL48 label sheet.

H. Copper Work Area Outlets (WAO):

1. Top of faceplate shall be labeled with room designation in accord with FISH numbering system where horizontal cable is terminated (MDF, IDF, or CP) and the room the faceplate/WAO is in. FISH numbering system is indicated on drawings. See example below.
2. Face plate labeling shall use Siemon CT-FP-LBL-104 label and MX-FP-CVR-00 label cover.
3. WAO should be identified on the label specified above starting at the first outlet to the right of the primary entrance door when entering the room. The first outlet will be identified as “A”, the second outlet to the right of the door will be “B”, and continuing in a counterclockwise fashion around the room until all WAOs are identified with their own respective letter.
4. For example, a D4 WAO faceplate in room 112 that is the third WAO in the room from the right of the main entrance door that is served from serving closet room 192 would be labeled “192.112.C”, 192 being the serving room number, 112 being the current room location, and C being the drop identifier.
5. Labels shall be machine printed using Siemon part number above; no handwritten labels permitted.
6. Channel color icons are Siemon PN#: Z-ICON-(XX)-B, where (XX) is replaced by the color needed: 03 = Red, 06 = Blue, 07 = Green, 05 = Yellow, 09 = Orange, 08 = Violet
7. Channel color icon order is: Red, Blue, Green, Yellow, Orange, Violet. For example, a D2 WAO will only have channels red and blue; a D6 WAO will have red, blue, green, yellow, orange, violet in that order.

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I. Wireless Access Point Copper Work Area Outlets (WAO):

1. Top of faceplate or box shall be labeled with room designation in accord with FISH numbering system where horizontal cable is terminated (MDF, IDF, or CP) and the room the faceplate/WAO is in. FISH numbering system is indicated on drawings. See example below.
2. Face plate or box labeling shall use Siemon CT-FP-LBL-104 label and MX-FP- CVR-00 label cover.
3. Wireless Access Point WAOs should be identified on the label part number specified above with the drop identifier “WAP”. If multiple in-ceiling WAOs exist for WAPs in the same room, they shall be incremented numerically starting with number “1”.
4. For example, a D2WAP WAO faceplate in room 107 that is the second WAP WAO in the room that is served from serving closet room 197 would be labeled “197.107.WAP2”, 197 being the serving room number, 107 being the current room location, and WAP2 being the drop identifier.
5. Labels shall be machine printed using Siemon part number above; no handwritten labels permitted.
6. Where the D2WAP or D4WAP is located above the finished ceiling, use a handheld labeler to mark the ceiling grid with the same labeling nomenclature for the faceplate, as specified above.
7. Channel color icons are Siemon PN#: Z-ICON-(XX)-B, where (XX) is replaced by the color needed: 03 = Red, 06 = Blue, 07 = Green, 05 = Yellow, 09 = Orange, 08 = Violet
8. Channel color icon order is: Red, Blue, Green, Yellow, Orange, Violet. For example, a D2WAP WAO will only have channels red and blue; a D6WAP WAO will have red, blue, green, yellow, orange, violet in that order.

J. Project records shall be provided to Owner at project completion as part of closeout submittals identifying location and nomenclature of each item.

1. Documentation shall be on hard copy and on Flash Drive(s). Written documents shall be in Word format and include manufacturer’s written product information.
2. Project record drawings shall be provided on Flash Drives to Owner in AutoCAD format and shall be AutoCAD Release 10 or later edition.

K. Comply with Section 01 78 00 - Closeout Submittals.

PART 2 – PRODUCTS

2.1 HANDHELD LABELERS

A. Provide labels for ISP Cable, OSP (horizontal) cables, racks, grounding busbars and as indicated.

B. Size labels according to cable diameter and readability.

C. Labels shall be machine made, designed for commercial application, and self-adhesive.

2.2 FACEPLATE, PATCH PANEL, AND WALL BLOCK LABELS

A. Faceplates, patch panels, and wall blocks shall have integral slot for insertion of device identification labels as specified in each section above, use manufacturer part number specified in this document.

B. Where device does not have integral label insert, submit proposed labeling method to be approved by customer.

2.3 GROUNDING AND BONDING CONDUCTORS

A. Warning Marker: non-metallic, machine made, preprinted as wrap-around marker (flag marker is not acceptable) as manufactured by Panduit, LTYK Grounding and Bonding Label Kit.

B. Size labels according to cable diameter and readability.

C. Labels shall be machine made, designed for commercial application, and self-adhesive.

D. Label TMGB (Telecommunications Main Grounding Bus Bar) as 114-TMGB, where 114 indicates room number where TMGB is located.

E. Label TGB (Telecommunications Grounding Bus Bar) as 138-TGB, where 138 indicates room number where TGB is located.

F. Label grounding conductors within 12” (304mm) of both ends with warning marker and identification label.

G. Identification label shall include source and destination of grounding conductor.

PART 3 - EXECUTION

3.1 GENERAL

A. Comply with TIA/EIA-606-A - Administrative Standard for Commercial Telecommunications Infrastructure identification of communication devices, wiring, and system components.

B. Labels shall be physically accessible and easily read.

C. Communications rooms where cabling is terminated or originated are referred to in documents as MDF and IDF Rooms on floor plans and room finish schedules.

D. Space numbers indicated on Dwgs are Owner’s FISH (Florida Inventory of School Houses) numbers and shall be used to denote cable origination and termination points. FISH numbers have five digits (two digits for the building number followed by dash and three digits for space number). First floor spaces begin with 100, second floor spaces are 200 series, and third floor spaces are 300 series.

E. Sites will generally have one MDF room per site and each building will generally have one IDF room on each floor level unless the rooms on same floor exceed total cable run greater than 300 feet from IDF room.

F. Typical space number for MDF would be 02-114 (Bldg. 02, Space 114 on the first floor). IDF space would be 02-211 (Bldg. 02, space 211 on the second floor).

3.2 LABELING

A. Equipment Racks:

1. Equipment racks shall be labeled with 0.375 inch high text in Ariel font.
2. Racks shall be numbered facing racks from left to right, from front (nearest access door) to back of space.
3. Labels shall include Telecommunications Room (IDF/MDF) number followed by dash and rack number: Example: Rack 114-01, 114-02, 114-03, etc.
4. Labels shall be placed at top and bottom of front and rear of each equipment rack.

B. Patch Panels:

1. Label shall be at center of patch panel with identification as PP# (example: A-Z, top to bottom, skipping I and O).
2. Each rack starts over with new rack number and patch panel alpha labeling scheme to bottom, skipping I and O).
3. Patch panels serving wireless access points, add “WAP” as suffix.

C. Terminations for Patch Panels and 110-blocks.

1. Utilize available inserts: print with inkjet or laser printer, including full labeling scheme.
2. Example of Patch Panel and 110-block description: 114-1-A01, where 114 is room number, “01” is Rack #1, “A” is patch panel “A”, and “01” is patch panel position (add “WAP” suffix for outlets to wireless access points.

D. Inside Plant (ISP) Horizontal Cabling:
   1. Label within 6” (152mm) at both cable termination ends.
   2. Example of ISP description: 114-01-A01, where 114 is Telecommunications Room number, “01” is Rack #1, “A” is patch panel “A”, and “01” is patch panel position (add “WAP” suffix for outlets to wireless access points.
   3. For cables routed through junction boxes and pull boxes, group cables together by destination (room) via Velcro-strap, and flag (identify) that destination near Velcro strap.

E. Outside Plant (OSP) Horizontal Cabling:
   1. Label transition point (if utilized) as “COMMUNICATIONS OSP TRANSITION POINT”.
   2. Label cables at transition point within 6 inches at both termination ends.
   3. Example of OSP description: 114-01-A01, where 114 is Telecommunications Room number, “01” is Rack #1, “A” is patch panel “A”, and “01” is patch panel position (add “WAP” suffix for outlets to wireless access points.

F. Faceplates:
   1. Communications outlet faceplates shall be permanently marked with machine generated labels, complying with EIA/TIA 606, matching numbering plan on approved Shop Drawings.
   2. Utilize faceplate label inserts if available. If faceplate has no insert, attach directly to faceplate with adhesive label.
   3. Labels shall be mounted level and plumb with square edges and alignment with other faceplates.
   4. Example of faceplate description: 114-01-A01, where 114 is Telecommunications Room number, “01” is Rack #1, “A” is patch panel “A”, and “01” is patch panel position (add “WAP” suffix for outlets to wireless access points.

G. Copper Backbone (between Telecommunications Rooms):
   1. Locate label within 6 inches at both cable termination ends starting with nearest end identification with a slash mark followed by farthest end identification.
   2. Example of cable label description: 114-01:24:12/138-01:12:6, where the cable origination is located in Telecommunications Room number 114, “01” is Rack #1, “24” is panel in equipment rack, and 12 is port in panel 24. The cable termination is located in Telecommunications Room number 138, “01” is Rack #1, “12” is panel in equipment rack, and 6 is port in panel 12. Cable designation in Telecommunications Room number 138 is reversed (138-01:12:6/114-01:24:12).

H. Fiber Backbone (between Telecom Rooms):
   1. Locate label within 6 inches at both cable termination ends starting with nearest end identification with a slash mark followed by farthest end identification.

3.3 PATHWAYS

A. Conduit
   1. Label exterior conduit as “COMMUNICATIONS” (unless otherwise noted) with text readable from standing position on finished floor.
   2. For wall stub-up locations, for future use, label end of stub-up conduit in Telecommunications (MDF and IDF) Rooms only.
   3. For overhead conduits, label both ends in Telecommunications (MDF and IDF) Rooms.

4. For long runs of conduit that stub-up into Telecommunications (MDF and IDF) Rooms, label end of conduits in Telecommunications (MDF and IDF) Rooms with destination room name and number or locations without space numbers such as Elevators.
5. Sleeves passing through single wall or floor do not have to be labeled, unless walls are fire rated.

B. Junction Boxes and Pull Boxes:

1. Label exterior of junction boxes and pull boxes as “COMMUNICATIONS” with text readable from standing position on finished floor.

C. Firestop Locations:

1. Communications firestop locations identified on Drawings shall be labeled on both sides of walls or floors. Comply with Section 07 84 00 - Firestopping.

3.4 GROUNDING

A. Label TMGB (Telecommunications Main Grounding Bus Bar) as 114-TMGB, where 114 indicates room number where TMGB is located. The first digit of room number indicates first floor.

B. Label TGB (Telecommunications Grounding Bus Bar) as 138-TGB, where 138 indicates room number where TGB is located. First digit of room number indicates first floor.

C. Label grounding conductors within 12 inches of both ends with warning marker and identification label.

1. Identification label shall include source and destination of grounding conductor.

END OF SECTION

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SECTION 27 11 13 - COMMUNICATIONS ENTRANCE PROTECTION

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Installation of over voltage and current protective devices for telecommunications cabling with surge protection modules for protection of cabling and equipment for MDF entrance cabling and cabling between buildings to IDF rooms.

B. Protective modules shall be installed in wall mounted enclosure and connected with #6AWG copper bonding conductor between protector ground lug and Communications Grounding Busbar (TGB) in MDF and IDF rooms.

1.2 REFERENCES

A. See Section 01 42 00 – References for additional reference standards, definitions, abbreviations, and acronyms.

B. National Fire Protection Association (NFPA): NFPA 70 - National Electrical Code.

C. American National Standards Institute/Telecommunications Industry Association/Electronic Industries Association (ANSI/TIA/EIA).

1. ANSI/TIA/EIA-568-2020 – Standard for Installing Commercial Building Telecommunications Cabling.
2. ANSI/TIA/EIA-568C – Commercial Building Telecommunications Cabling.
3. ANSI/TIA/EIA-569C – Telecommunications Pathways and Spaces.
4. ANSI/TIA/EIA-606A – Labeling Standards for Networks.
5. ANSI/TIA/EIA-J-607A – Standard for Telecommunications Bonding and Grounding, Planning, and Installation Methods for Commercial Buildings.
6. ANSI/TIA/EIA-758B – Customer Owned Outside Plant Telecommunications Infrastructure Standards.

D. Underwriters Laboratories (UL).

1. UL 497/497A – Protectors for Paired Conductor Communications Circuits.
2. UL 1449 – Surge Protection Devices.

E. Building Industry Consulting Services International (BICSI):

1. Telecommunications Distribution Methods Manual (TDMM).
2. Information Transport Systems Installation Methods Manual (ITSIMM).

1.3 SUBMITTALS

A. Comply with Section 01 33 00 - Submittal Procedures.

B. Product Submittals:

1. Provide manufacturer’s product data sheets and specifications with specific product number identified or filled out clearly marking specific products and model numbers.
2. Provide product lists for each item specified.

C. Shop Drawings:

1. Provide scaled drawings of floor plans and elevations of each MDF and IDF room indicating product layouts identifying each product.

1.4 QUALITY ASSURANCE

A. Comply with Section 01 45 00 - Quality Control.

B. Communication entrance protection equipment shall be UL approved.

C. Installer shall be authorized by manufacturer and certified to install listed products.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Protector modules shall be as manufactured by Circa Enterprises, Inc., 206, 5 Richard Way SW, Calgary, AB, T3E 7M8, Canada; Tel: 403-258-2011; Website: www.circaent.com.

B. Other manufacturers shall comply with Section 01 25 13 – Product Substitution Procedures.

2.2 BUILDING ENTRANCE TERMINALS (BET)

A. Building Entrance Terminal Enclosures:

1. Circa Enterprises, Inc.: Model 4B1S-300, utilizing positive temperature coefficient technology (PTC) with self-resetting current limiters.
2. Solid state, UL approved.
3. ISO 9002 Certified Manufacturer.

B. Other materials as required for complete and functioning telecommunications grounding system.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install equipment in accordance with manufacturer’s typed instructions.

B. Where protective devices are located in MDF and IDF rooms, locate protector on plywood backboard.

C. Label protector and outlet identifier in accord with Section 27 05 53 – Identification of Communication Systems and as indicated.

D. Install protective enclosures and grounding conductors neatly, aligned, plumb and level.

END OF SECTION

SECTION 27 11 16 - COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Supply and installation of cabinets, racks, frames, enclosures, anchorage attachments and accessories required for communications room equipment.

1.2 REFERENCES

A. See Section 01 42 00 – References, and Section 27 05 00 – Common Work Results for Communications Systems for additional reference standards, definitions, abbreviations, and acronyms.

B. NFPA 70 - National Electrical Code; National Fire Protection Association; 2020 Edition.

1.3 QUALITY ASSURANCE

A. Comply with Section 01 45 00 – Quality Control.

B. Communications network installer shall be certified by equipment manufacturer. Installer shall have five continuous years' experience in telecommunications installations.

C. Installer shall have Registered Communications Distribution Designer (RCDD) on his staff to certify that installation is compliant with applicable industry standards and is installed in accord with contract documents.

D. Ground equipment racks in accord with Section 27 05 26 Grounding and Bonding for Communications Systems.

1.4 SUBMITTALS

A. Comply with Section 01 78 00 – Closeout Submittals.

B. Project Record Drawings shall be submitted indicating layouts of cabling locations and communications room layouts.

1.5 STORAGE AND HANDLING

A. Comply with Section 01 66 00 – Product Storage and Handling Requirements.

B. SCS Installer shall be responsible for coordinating storage of equipment at project with Contractor/CM in secure and conditioned space.

C. Protect equipment from environmental and physical damage from project delivery to Owner's final acceptance of project.

D. Installer shall have separate keying system for equipment storage spaces, MDF and IDF rooms, so that other building trades shall coordinate with the SCS installer for entrance to those spaces.

E. SCS installer and Contractor/CM shall be responsible for SCS vandalism, theft, or damage.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Approved Manufacturers:

1. Manufacturers. The Siemon Company, Siemon Business Park, 101 Siemon Company Dr., Watertown, CT 06795-0400; Tel: 860-945-4200; Fax: 860-945-
2. 4225; Website: www.siemon.com.
3. Ortronics Corporation, 125 Eugene O'Neill Dr., New London, CT 06320; Tel: 1
4. 887 599- 5393; Fax: 1 888 282-0043: website; www.ortronics.com.
5. Chatsworth Products Inc., 701 Industrial Dr., New Bern, NC 28562. Tel: 252-514-
6. 2779; Fax: 252-514-2977; website: www.chatsworth.com.

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7. Communications Supply Corp. (Hubbell), 200 East Lies Rd., Carol Stream, IL 60188. Tel: 1-877-462-7271; website: gocsc.com.
8. Middle Atlantic Products, Inc., Tel: 873-839-1011; Fax: 973-839-1976; website: middleatlantic.com.
9. Hellerman-Tyton, 7930 N. Faulkner Rd., P. O. Box 245017, Milwaukee, Wisconsin 53224. Tel: 800-537-1512; Fax: 800-848-9866; website: hellermantytan.com.
10. Panduit Corp., 17301 Ridgeland Ave., Tinley Park, IL 60477; Tel: 800-777-3300,
11. 708- 532-1800; Fax: 708-532-1811; Website: www.panduit.com.

B. Other manufacturers shall comply with Section 01 25 13 - Product Substitution Procedures.

C. Four Post Racks:
1. Manufacturer: Chatsworth Products Inc.
    a. Quadrarack™ Server Frame, Model #15053-703, 84” (213cm) H x 19” (48cm) W x 29” D (73.7 cm), 45RMU, black with square punched hardware kits #1261-001, as required.
2. Manufacturer: The Siemon Company
    a. Siemon RSQ1-07C-S, 4 Post rack, 19 Inch Width, 45U / 7 Feet, Steel, Black, Cage Nut, Adjustable.
3. Manufacturer: Ortronics Corp.
    a. Mighty-Mo 10 Server Rack, Model #OR-MM107SVR, 84” (213cm) H, 19” (48cm) W x 12.5” (30.5 cm) to 30” (76.2 cm) D (adjustable), 45 RMU, black.

D. Two Post Racks:
1. Manufacturer: Chatsworth Products Inc.
    a. Model #: 55053-703, 84” (213cm) H x 19” (48cm) W x 29” D (73.7cm) W, 45RMU.
2. Manufacturer: The Siemon Company
    a. Siemon RS1-07-S, 2 Post rack, RS1 Value, 19 Inch Width, 3 Inch Depth, 45U / 7 Feet, Steel, Black, #12-24 Screw.
3. Manufacturer: Ortronics Corp.
    a. Mighty-Mo 6 Cable Management Rack, Model #OR-MM6706, 84” (213cm) H, 19” (48 cm) W x 6.5” (16.5 cm) D, 45 RMU, black.

E. Wall mounted Communications Point (CP) cabinet:
1. Manufacturer: Chatsworth Products Inc.
    a. 24” part number: 11900-724
    b. 36” part number: 11900-736
    c. 48” part number: 11900-748

F. Rack Base Insulator Kit
1. Manufacturer: Chatsworth Products Inc.
    a. Part #: 10605-019, 2 isolation plates and 4 isolation grommets.
2. Manufacturer: Ortronics Corp.
    a. Part #: OR-MMIPK Isolation Pad Kit with 2 isolation plates and 4 isolation grommets.

G. Vertical Cable Management
1. Manufacturer: Panduit, Corp.

a. Model #: WMPV45E, 83” H x 4.24” W with Front and Real Duct, black, 45RMU ROHS with round head machine screws, wire retainers and covers.

b. Wider option can be used as needed.

2. Manufacturer: The Siemon Company

a. Model #: VCM1A-06D-1-45 Cable Manager, Vertical, Value, Double Sided, 6 Inch Fingers, 6 Inch Width, 45U / 7 Feet, Door, Black.

b. Wider option can be used as needed.

H. Horizontal Cable Management

1. Manufacturer: Panduit, Corp.

a. Model #: WMPH2E, 3.5” (88.9mm) H x 19” (482.6mm) W x 8.9” (225.5mm) D;

b. 2 Rack Space Manager, Front and Rear.

2. Manufacturer: The Siemon Company

a. Model #: HCM-4-2U-D Cable Manager, Horizontal, Route IT, Double Sided, 4 Inch Fingers, 19 Inch Width, 2U, Standard Cover, Black.

I. Horizontal Cable Management Trays shall be 12” (30.4cm), 18” (56.4cm) or 24” (60.8cm) wide as required to support cable bundles not greater than 3” high across full panel width. Makes and models as specified in Section 27 05 36.

J. Accessories.

1. Manufacturer: Hellermann Tyton - Flexiform Grommet.

2. Manufacturer: Middle Atlantic Products - protective grommet (GR-30).

3. Manufacturer: The Siemon Company – Blank Filler Panel PN #: PNL-BLNK-1 and PNL-BLNK-2.

PART 3 - EXECUTION

3.1 INSPECTION

A. SCS installer shall inspect spaces where equipment is to be located. Immediately notify Contractor/CM of conditions that precludes successful equipment installation.

B. Buildings in which equipment is to be placed shall be thoroughly cleaned and shall have operating HVAC system to maintain temperature and humidity at conditions equal to final building occupancy.

C. Start of equipment installation shall be deemed installer’s acceptance of building conditions.

3.2 INSTALLATION

A. Install cabinets, racks, enclosures, and accessories in accord with manufacturer’s printed installation instructions where indicated.

B. Locate power outlet strips in equipment racks at the 22U or 23U (middle of rack) slot. Makes and models as specified in Section 27 11 26.

C. Leave 3U of space between each copper patch panel to allow for two-1U blanks and 1U for the customer provided data switch.

D. Provide wire management rings, ladder rack, brackets, wire management panels for neat and workmanlike installation.

E. Each unused opening U on two-post racks should be blanked using Siemon Blank Filler Panel as specified above (1U or 2U as needed), with the Siemon logo facing outward.

F. Use Velcro cable ties in network rooms. No plastic or metal cable ties shall be used.

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G. Installation of Cat 6 cabling in vertical cable management and cable trays should utilize a cable comb or similar tool to ensure neat, straight, and untangled installation.

H. When configuring multiple racks in line, vertical cable management between racks shall be larger size, while smaller channels may be used at ends.

I. Provide vertical cable management sized for no more than 40 percent fill.

J. Securely fasten side-by-side racks to each other using rack manufacturer’s standard hardware.

K. Bag and leave attached to rack unused mounting screws, cage nuts, or other hardware upon completion.

L. Mount with minimum of 36” (914.4 mm) clear access behind and in front of rack/cabinets.

M. Ground rack/enclosure to TMGB/TGB with Grounding Wire as specified in section 27 05 26 Grounding and Bonding for Communications Systems

END OF SECTION

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SECTION 27 11 19 - COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. Supply and installation of terminal blocks, patch panels, and accessories in equipment rooms to provide fully functional communications system.

1.2 REFERENCES

A. See Sections 01 42 00 – References and 27 05 00 - Common Work Results for Communications for additional reference standards, abbreviations, definitions, and acronyms.

B. NFPA (National Fire Protection Association): NEC 70, 2020 Edition.

1.3 QUALITY ASSURANCE

A. Comply with Section 01 45 00 – Quality Control.

B. Horizontal Copper Rack Terminations:

1. Horizontal cables for new construction shall be terminated in T568B pin/pair configuration. Terminate (punch down) four wiring pairs per jack port.
2. Horizontal cables for existing buildings shall conform to existing termination scheme which may be either T568A or T568B. Verify existing termination style in multiple areas of the existing campus and receive confirmation from Owner before terminating new cables.
3. Cables shall be neatly dressed to respective patch panel and within manufacturer cable management using Velcro cable ties and/or rack cable management loops. Cables shall be bundled between 25 and 30 cables together outside of rack using a cable comb and shall not be loose and random in cable tray.

C. Fiber Rack Terminations:

1. Terminate fiber on rack mounted patch panel in fiber tray. Fiber-optic connecting hardware shall support individually terminated fibers onto connectors. Fiber trays shall be limited to single type of fiber (multimode or single mode).
2. Terminate fiber in appropriately sized, rack mountable enclosures.
3. Optical patch panels shall meet ANSI EIA/TIA-568-A wiring standard for connecting hardware.
4. Fiber termination panels shall be mounted at top of left-most (first) rack in closet or cabinet.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Approved Manufacturers:

1. The Siemon Company, Siemon Business Park, 101 Siemon Company Dr., Watertown, CT 06795-0400; Tel: 860-945-4200; Fax: 860-945-4225; Website:

   www.siemon.com.

B. Category 6 Copper Patch Panels:

1. Manufacturer: Siemon Company.
   i. Model # UP6-F1-24K-RS, Copper, Patch Panel, UltraMAX, with Jacks, UTP, Category 6, 24 Port, Flat, 1U, Black, Detached Wire Manager
   ii. Model # UP6-F2-48K-RS, Copper, Patch Panel, UltraMAX, with Jacks, UTP, Category 6, 48 Port, Flat, 2U, Black, Detached Wire Manager

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C. Fiber Terminations:

1. Manufacturer: Siemon Company:

i. Fiber tray PN#: LVE-1U-MD-P01A Fiber, Enclosure, Light Verse Pro, Rack Mount, 1U, Sliding Access, 4 Openings, Black.

ii. Adapter plates as required:

1. Multimode PN#: LVA12-LCQ-BC-A Fiber, Adapter Plate, Light Verse, 12 Fiber, LC, Flat, Aqua Adapter, Black Housing, Ceramic Sleeve.

2. Single mode PN#: LVA12-LCP-BC-A Fiber, Adapter Plate, Light Verse, 12 Fiber, LC, Flat, Beige Adapter, Black Housing, Ceramic Sleeve.

iii. Blank any unused openings with PN#: LVA-BLANK-01A Fiber, Adapter Plate, Light Verse, Flat, Black Housing, Blank.

D. Copper Patch Cords for Patch Panels:

1. Manufacturer: Siemon Company:

i. Data circuits: Model # MC6-01-01, Copper, Patch Cord, RJ45, RJ45, Category 6, UTP, T568A/B, Stranded, CM/LSOH-1, Black Cable, Clear Boot, 1 Feet, 26 AWG

ii. Camera circuits: Siemon: Part #MC6-01-09 orange.

iii. Audio Enhancement amplifier circuits: Siemon: Part #MC6-01-08 violet.

E. Additional materials needed to properly terminate and secure cables, including but not limited to panel and plate connectors, grounding kits, strain-relief hardware, break-out kits, blank panels, and plates.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Horizontal Cable Rack Terminations:

1. Horizontal cable shall be installed per manufacturer printed instructions to ensure manufacturer certified solution.

2. Provide and install modular patch panels as indicated on Drawings.

3. Terminate horizontal cables in T568B pin/pair configuration unless T568A is in use in existing cabling and has been approved by the Owner. All four pairs shall be terminated. See section 1.3-B of 27 11 19 for further information.

4. The first patch panel will be the start of the cabling sequence. All horizontal cables that serve the lowest room FISH number served out of this closet should be the first cables on the patch panel, increasing sequentially by drop identifier for the room (A first, B second, etc.), then by room number until the greatest room number is on the last WAO patch panel.

5. The last patch panel(s) shall be reserved for the WAP patch panel(s).

6. Neatly dress cables to respective patch panel using manufacturer wire management for patch panel and within rack cable management using Velcro cable ties and rack cable management loops. Cables shall be bundled between 25 and 30 cables together outside of rack using a cable comb and shall not be loose and random in cable tray.

7. Provide identification labels for each cable in accord with Section 27 05 53 – Identification for Communications Systems.

B. Optical Fiber Rack Terminations:

1. Provide and install rack-mounted optical fiber trays where indicated.
2. Terminate fibers using dual LC connector panels and plates, and fiber connectors.
3. Place fiber slack neatly in fiber housing.
4. Secure cable strength members to cable strain relief brackets or attachment points within fiber housing.
5. Install blank panels and plates to fill empty locations within fiber housings.
6. Install additional materials to properly terminate and secure inter-building and intra-building optical fiber cables, including panel and plate connectors, grounding kits, strain-relief hardware, break-out kits, blank panels, and plates.
7. Provide identification labels for adaptors.

3.2 LABELING

A. Terminal blocks, patch cords and patch panels shall be labeled in accord with Section 27 05 53 – Identification for Communications Systems.

END OF SECTION

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SECTION 27 11 23 - COMMUNICATIONS CABLE MANAGEMENT AND CABLE TRAYS

PART 1 - GENERAL

1.1. SCOPE OF WORK

A. Labor, supervision, materials, equipment, and services for fully functional cable runway support system to include cable and wire mesh cable trays, hangers, supports, and accessories.

1.2 REFERENCES

A. See Section 01 42 00 - References for additional reference standards, definitions, abbreviations, and acronyms.

B. National fire Protection Association (NFPA):

1. NFPA 70, 2011 Edition, National Electrical Code.
2. NFPA 70B, 2013 Edition, Recommended Practice of Electrical Equipment Maintenance.

C. American National Standards Institute (ANSI):

1. TIA/EIA-568A - Commercial Building Telecommunications Cabling Standard.
2. TIA/EIA-569 - Commercial Building Standard for Telecommunications Pathways and Spaces; Rev. A, 1998, and relevant Addenda (ANSI/TIA/EIA-569).
3. TIA/EIA-606-A - Administration Standard for Telecommunications Infrastructure of Commercial Buildings, 2002.
4. TIA/EIA-607-A - Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, 2002.

D. National Electrical Manufacturer's Association (NEMA):

1 NEMA VE 1 - Metallic Cable Tray Systems, 2002.

2 NEMA VE 2 - Metallic Cable Tray Installation Guidelines.

E. Building Industry Consulting Industry, Inc. (BICSI): Telecommunications Distribution Methods Manual, 11th Edition, 2009.

1.3 QUALITY ASSURANCE

A. Comply with Section 01 45 00 Quality Control. Comply with Reference Standards indicated.

B. Cable runway shall be classified by Underwriter's Laboratory (UL).

C. Provide products listed and classified by Underwriters Laboratories, Inc., as suitable for purpose specified and indicated.

D. Cable trays, supports and related accessories shall be new, defect free, and from one manufacturer.

1.4 DESIGN CRITERIA

A. Provide ladder and wire cable tray sizes based on numbers and types of wire indicated not to exceed 50% of ladder and wire tray capacity.

B. Cable trays and supports shall be designed by Florida Registered Structural Engineer, based on cable loading, size and length of ladder or wire units, and support elements.

1.5 SUBMITTALS

A. Comply with Section 01 33 00 - Submittal Procedures.

B. Product Data: Submit manufacturer's descriptive literature for each cable tray system, tray support and attachment components, and accessories specified or indicated.

C. Shop Drawings:

1. Submit runway layouts for each cable tray type and location, dimensions, support points, and finishes.

2. Cable tray layouts, floor plans and sections shall be drawn to scale and shall include:
    a. Relationships between components and adjacent structural, electrical, and mechanical elements.
    b. Vertical and horizontal offsets and transitions.
    c. Clearances for access above and to side of cable trays.
    d. Vertical elevations of cable trays above floor or below bottom of ceiling structure.
3. Provide manufacturer's catalog data for fastening systems.

D. Submit manufacturer's printed installation instructions for installation, including product storage, protection, and handling requirements.

E. Comply with Section 01 78 00 - Closeout Submittals: If variations from approved shop drawings occur during installation of raceway system, submit Project Record Documents indicating system installed based on final locations.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with Section 01 66 00 - Product Storage and Handling Requirements.

B. Deliver and store cable trays, racks, and accessories products in manufacturer's unopened packaging in clean dry area, protected from weather and construction traffic until installation.

C. Maintain storage area conditions for products in accord with manufacturer's printed instructions.

PART 2 – PRODUCTS

2.1 APPROVED CABLE TRAY MANUFACTURES

A. Chatsworth Products Inc., 701 Industrial Dr., New Bern, NC 28562. Tel: 252-514-2779; Fax: 252-514-2977; Website: www.chatsworth.com

B. Cooper B-Line - USA, Division of Cooper Industries, PLC, 509 West Monroe St., Highland, IL 62249; Tel: 800-851-7415; Fax: 800-356-1438; Website: www.cooperindustries.com.

C. Cablofil, Division of Legrand, 8319 State Route 4, Mascoutah, IL 62258; Tele: 618-566- 3230; Fax:618-566-3250; Website: www.legrand.us/cablofil.com.

D. Panduit, Corp.,18900 Panduit Dr., Tinley Park, IL 60478; Tel: 800-777-3300, 708-532- 1800; Email: www.panduit.com.

E. Enrico International Corp., 34600 Solon Rd., Solon, OH 44139; Tel: 800-753-9221; Fax: 440-248-0723; Website: www.erico.com

F. Velcro USA, Inc., 406 Brown Ave., Manchester, NH 03103; Tel: 800225-0180; Fax: 603- 669-9271; Website: Velcro.com.

G. Other manufacturers may submit for product substitution per Section 01 25 13 - Product Substitution Procedures.

2.2 WIRE BASKET CABLE TRAYS

A. Approved Products:
1. ONTRAC® wire basket cable tray by Chatsworth Products, Inc.
2. FLEXTRAY™ Wire Basket Cable Support System by B-Line - USA, Division of Cooper Industries, PLC.
3. Cablofil Wire Basket Cable Tray by Legrand.

B. Wire Basket Cable Tray Design:
1. Configuration: 2" x 4" wire mesh stainless steel with intersecting welded wire mesh and continuous longitudinal wires.
2. Tray unit length: 10 feet.

3. Wire basket depth shall be minimum 2 inches deep by minimum 12 inches width, with width sized to support maximum 3 inches diameter cable bundles in one row across cable tray.
4. Tray wire shall be black polyester baked paint coated A36 steel bars.
5. Fittings and hardware shall be as recommended by manufacturer for equipment and cable routing and support.
6. Loading of trays shall not exceed manufacturer's load span criteria.

2.3 CABLE RUNWAYS

A. Approved Products:
1. TELCO-STYLE cable runway by Chatsworth Products, Inc.
2. REDI-RAIL™ ladder cable tray by Cooper B-Line - USA, Division of Cooper Industries, PLC:
3. ITRAY ladder cable tray by PW Industries, Inc., Division of Legrand/Cablofil.

B. Cable Runway Design:
1. Configuration: 1.5" h x 0.375" w x .065" thick stringers with .5"w x 1"w x .065" thick cross members welded to stringers at 9 inches o.c.
2. Tray unit length: 9'- 8.5 inches.

2.4 J-HOOKS

A. Approved Products:
1. Cable Hook Model BCH Series by Cooper B-Line - USA, Division of Cooper Industries, PLC for sizes as recommended by manufacturer for number of cables.
2. Cable Hook: Caddy Cablecat Model CAT21, 32 or 64 by Enrico for sizes as recommended by manufacturer for number of cables.

2.5 CABLE TIES

A. Approved Products:
1. Velcro® One-Wrap Ties, sized for cable bundles as recommended by manufacturer.
2. Fire retardant cable ties shall be used in plenum environments.

2.6 ANCHORS AND FASTENERS

A. Accessories:
1. Provide manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, and connectors.
2. Provide bushings or rubber edge trim as needed. Products shall be free of sharp edges or points that may damage cables.

B. Anchors and Fasteners:
1. Obtain permission from Owner's Project Manager before using powder-actuated anchors.
2. Concrete Structural Elements: Use precast inserts, expansion anchors, powder-actuated anchors, or preset inserts.
3. Steel Structural Elements: Use beam clamps, steel spring clips, steel ramset fasteners, or welded fasteners.
4. Concrete Surfaces: Use self-drilling anchors or expansion anchors.
5. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts or hollow wall fasteners.
6. Solid Masonry Walls: Use expansion anchors or preset inserts.

7. Sheet Metal: Use sheet metal screws.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Verification of Conditions: Verify that substrates are prepared and ready to receive products specified.

B. Install components of raceway systems in accord with Drawings, Shop Drawings, and manufacturer's written installation instructions.

C. Do not exceed 50% cable fill.

D. See Section 27 14 00 – Communications Cabling for wiring installation.

3.2 CABLE TRAY SYSTEM

A. Install cable tray securely, in neat and workmanlike manner, per NECA 1.

B. Cut cable tray using manufacturer's equipment, if available from manufacturer. Smooth rough or jagged edges and points.

C. Arrange supports to prevent misalignment during wiring installation.

D. Fasten support to building structure and surfaces.

E. Cable tray elements shall be supported with manufacturer's hardware to provide minimal profile. Suspension shoes and brackets shall be used in place of trapeze struts. Sharp corners and threaded rod shall not extend below the basket.

F. Install cable trays maintaining following minimum clearance:

1. 12 inches of unobstructed clearance above cable tray's highest plane
2. 6 inches from source of EMI.
3. 12 inches from heat source exceeding 104-degrees F.

G. If cables rise to ceiling space of floor above network room greater than 12 feet, install cable tray to relieve vertical weight from cables on each floor. Secure cables with Velcro-type straps as needed to relieve vertical weight strain.

H. Continuous support elements shall be bonded from ground to TMGB/TGB with grounding wire. Sections may be bolted together or tied together with grounding jumpers if support structure is approved by manufacturer as a grounding conductor.

I. Provide pull strings in cable trays.

J. Provide fittings or gaps with bonding jumpers to accommodate expansion and deflection where cable tray crosses expansion joints.

K. Cable tray shall not penetrate fire-rated barriers. Cable tray shall end within 18 inches of fire-rated barriers. Cables shall use firestop assemblies or sleeves to penetrate fire-rated barriers.

L. Cable trays shall be installed in main corridors and in Communications Rooms. Cables running to other spaces shall utilize J-hooks.

M. Cable tray shall be single tiered wire basket installed to allow 12 inches of open space above and to one side of tray. Cable tray shall be 2 inches deep wire basket tray with appropriate width dimensions as required by volume of cable planned for installation at time of construction, and account for 20 per cent future growth.

N. Cable tray shall not be filled more than 50% capacity. Cable tray shall extend up to communications room wall to provide access to racks and walls in "T" design. Small rooms may use single, straight cable tray in line with rack, provided it extends parallel to face of rack.

O. Use at least 2 - 4 inches conduits where cable trays intersect with fire rated walls. Openings in conduit and between conduits and fire wall shall be protected in accord with Section 07 84 00. - Firestopping. Additional conduits may be required as cable volume dictates. Determination of conduits requirements shall be coordinated with Owner's Project Manager.

P. Install cable tray products within network rooms for vertical strain relief as needed while maintaining 50% additional capacity within support structure.

Q. Secure multiple cables in bundles with Velcro-type straps at minimum of 36 inches, or as recommended by manufacturer to relieve vertical weight strain.

R. Use appropriate hardware and parts to attach tray to permanent building structure (concrete columns or deck, structural steel, or other immovable structures capable of supporting cable tray). Parts shall be specifically designed and where possible UL-listed for final installed configuration.

3.3 HANGARS AND SUPPORT DEVICES

A. Attachment Devices.

1. Obtain Owner's project Manager's permission before using powder-actuated anchors.
2. Concrete Structural Elements: Use precast inserts, expansion anchors, powder-actuated anchors, or preset inserts.
3. Steel Structural Elements: Use beam clamps, steel spring clips, steel ramset fasteners, or welded fasteners.
4. Concrete Surfaces: Use self-drilling anchors or expansion anchors.
5. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts or hollow wall fasteners.
6. Solid Masonry Walls: Use expansion anchors or preset inserts.
7. Sheet Metal: Use sheet metal screws.
8. Wood Elements: Use stainless steel wood screws.

B. Install cable supports above concealed ceilings using rigid support to structural element or by attaching directly to structural element.

C. Install hangers and supports as required to support electrical system components adequately and securely, in neat and workmanlike manner, per NECA 1.

1. Do not fasten support to pipes, ducts, mechanical equipment, or conduit.
2. Installer may use existing threaded rods for other utilities, if pre-approved by Owner's Project Manager and can support additional load and maintaining clearances.
3. Do not drill or cut structural members.
4. Installation of hangars and supports to suspended ceiling grid support system in not allowed.

D. J-hooks may be installed with suspended ceiling grid wire with manufacturer clamps, provided:

1. Wire shall be painted orange prior to installation, to differentiate from ceiling grid support wires.
2. Wire shall not be used to support ceiling grid, as required by the NEC.

E. Weld support members shall use hexagon-head bolted fasteners to present neat appearance with adequate strength and rigidity. Use spring lock washers under nuts.

F. Support Category 6 cables with Cat 6 rated "J" hooks with wide base if supporting more than eight cables.

G. J-hook type supports shall be installed every 4-5 feet on center for runs exceeding 30 feet. Runs from main or secondary corridors into classrooms and offices do not require support.

H. Close J-hook supports with manufacturer who provided bars and not with cable ties. Do not use cable ties to strap cable to J-hook supports.

I. Bundled cabling shall be tied with cable ties at 36 inches o.c. Fire retardant cable ties shall be used in plenum environments.

3.4 CLEANING AND PROTECTION

A. Clean interior of cable trays, cables, anchorage devices, and wall ties to remove dust, debris, and other material.

B. Clean exposed surfaces and restore finishes.

C. Protect wire from damage. Replace entire cable if damaged.

END OF SECTION

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SECTION 27 11 26 - COMMUNICATIONS RACK MOUNTED POWER PROTECTION AND POWER STRIPS

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. Supply and installation of rack mounted battery backup and surge protection for power outage or interruption, and transient voltage surge protection for rack mounted electronic equipment.

1.2 REFERENCES

A. See Section 01 42 00 – References for additional reference standards, definitions, abbreviations, and acronyms.

B. National Fire Protection Association (NFPA):

1. NFPA 70, 2020 Edition, National Electrical Code.
2. NFPA 70B, 2020 Edition, Recommended Practice of Electrical Equipment Maintenance.

C. American National Standards Institute (ANSI):

1. TIA/EIA-568A – Commercial Building Telecommunications Cabling Standard.
2. TIA/EIA-569 - Commercial Building Standard for Telecommunications Pathways and Spaces; Rev. E, 2019, and relevant Addenda (ANSI/TIA/EIA-569).
3. TIA/EIA-606-A – Administration Standard for Telecommunications Infrastructure of Commercial Buildings, 2021.
4. TIA/EIA-607-A – Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, 2024.

D. Building Industry Consulting Service International (BICSI): Telecommunications Distribution Methods Manual, 15th Edition, 2024.

1.3 QUALITY ASSURANCE

A. Comply with Section 01 45 00 Quality Control. Comply with Reference Standards indicated.

B. Provide products listed and classified by Underwriters Laboratories, Inc., as suitable for purpose specified and indicated.

1.4 SUBMITTALS

A. Comply with Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer’s descriptive literature for rack mounted power protective devices, components, and accessories specified or indicated.

C. Provide manufacturer’s catalog data sheets for power protective devices.

D. Submit manufacturer’s printed installation instructions for installation, including product storage, protection, and handling requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with Section 01 66 00 – Product Storage and Handling Requirements.

B. Deliver and store power protective devices and accessory products in manufacturer’s unopened packaging in clean dry area, protected from weather and construction traffic until installation.

C. Maintain storage area conditions for products in accord with manufacturer’s printed instructions.

PART 2 – PRODUCTS

2.1 APPROVED POWER DISTRIBUTION UNIT MANUFACTURERS AND MODELS

A. APC AP9562 Rack PDU, Basic, 1U, 15A, 120V, (10)5-15.

B. Eaton PDU1215 basic PDU, 1PH, 1U, NEMA 5-15P input, 15 ft cord, 1.8kW, 12A, 120V, 13 Outlets (13) 5-15R

C. Other manufacturers may submit for approval of products per Section 01 25 13 – Product Substitution Procedures.

2.2 APPROVED BATTERY BACKUP POWER MANUFACTURES AND MODELS

A. APC SMTL3000RM2UCNC 3kVA, Lithium-ion, Rackmount 2U, 120V, 2x NEMA 5- 20R+6x NEMA 5-15R outlets, SmartConnect Port+Network Card, AVR, LCD

B. APC SMTL1500RM3UCNC 1500VA, Lithium-ion, Rackmount 3U, 120V, 2x NEMA 5-

C. 20R+6x NEMA 5-15R outlets, SmartConnect Port+Network Card, AVR

D. APC SCL500RM1UNC 500VA, Lithium-ion, Rackmount 1U, 120V, 4x NEMA 5-15R outlets, Network Card, Short Depth

2.3 ANCHORS AND FASTENERS

A. Accessories:

1. Provide manufacturer’s standard screws, clamps, brackets, and connectors.
2. Provide bushings or rubber edge trim as needed. Products shall be free of sharp edges or points that may damage cables.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Verify that racks are prepared and ready to receive power protective products specified.

B. Quantity 1 (one) 15a PDU to be located in each equipment rack at the 22U or 23U (middle of rack) slot.

C. 3000VA UPS models used in all MDF and IDF locations, excluding CP cabinets and IDF locations with 2 or less data switches. MDF locations shall receive 2 3000VA UPS.

D. 1500VA UPS models used in all IDF locations that have 2 or less data switches.

E. 500VA UPS models used in all CP cabinet locations.

1. More than one 500VA UPS can be used in a CP if load exceeds manufacturer specifications for a single unit.

F. Install power protective devices and components in accord with Drawings, Shop Drawings, and manufacturer’s printed installation instructions.

3.2 OPERATION

A. Comply with Section 27 05 00 – Common Work Results for Communications.

B. Test units to verify power protective devices operate properly and as intended.

3.3 CLEANING AND PROTECTION

A. Clean exposed surfaces.

B. Protect equipment from damage until project’s final acceptance.

END OF SECTION

SECTION 27 15 00 - COMMUNICATIONS CABLING

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. Single copper and multi-pair copper, fiber optical channel solution, riser or plenum rated cabling as required for horizontal cable and backbone fiber and copper distribution cable required for complete and fully functional communications system.

1.2 QUALITY ASSURANCE

A. Comply with NFPA 70 - National Electrical Code; National Fire Protection Association; 2020 Edition.

B. See Section 01 42 00 – References for additional reference standards, definitions, abbreviations, and acronyms.

C. See Section 01 45 00 – Quality Control for additional requirements.

D. Only cable manufacturers who comply with Siemon warranty requirements will be allowed to bid this work.

E. Project shall utilize Siemon System 6 solution. Installer and manufacturer shall provide warranty for single channel solution for complete and fully functional communications system.

F. Cabling indicated shall be rated for plenum or riser locations, and as indicated for given environment.

1.3 SUBMITTALS

A. Comply with Section 01 33 00 – Submittal Procedures and Section 01 78 00 – Closeout Submittals.

B. Product Data: Submit data for each specified product in accord with Section 01 33 00 – Submittal Procedures, and Section 27 05 00 – Common Work Results for Communications Systems.

1.4 WARRANTY

A. Manufacturer and SCS installer shall warranty Cat 6 structured cabling system for end- to-end channel model installation covering applications assurance, cable, connecting hardware and labor cost for repair and replacement for twenty (20) years from date of project’s substantial completion.

B. See Sections 01 78 00 – Closeout Submittals and 27 05 00 – Common Work Results for Communications for additional warranty requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with Section 01 66 00 – Product Storage and Handling Requirements.

B. Protect products from damage during delivery, storage, and installation. Replace damaged products at no added cost to Owner.

PART 2 – PRODUCTS

2.1 CABLE MANUFACTURERS

A. Approved Cable Manufacturer’s:

1. The Siemon Company, Siemon Business Park, 101 Siemon Company Dr., Watertown, CT 06795-0400; Tel: 860-945-4200; Fax: 860-945-4225; Website: www.siemon.com.

2.2 COPPER HORIZONTAL CABLING

A. Production network unshielded twisted pair, 4-pair 100-ohm, Category 6, plenum and/or non-plenum, blue:
   1. Siemon Company, Premium 6™, UTP, 4-pair cable.
   2. Plenum: Part #9C6P4-E3-06-RXA (blue).
   3. Riser: Part #9C6R4-E3-06-RXA (blue).

B. Security camera network unshielded twisted pair, 4-pair 100-ohm, Category 6, plenum and/or non-plenum, orange:
   1. Siemon Company, Premium 6™, UTP, 4-pair cable.
   2. Plenum: Part #9C6P4-E3-09-RXA (orange).
   3. Riser: Part #9C6R4-E3-09-RXA (orange).

C. Audio Enhancement amplifier network unshielded twisted pair, 4-pair 100-ohm, Category 6, plenum and/or non-plenum, violet:
   1. Siemon Company, Premium 6™, UTP, 4-pair cable.
   2. Plenum: Part #9C6P4-E3-08-RXA (violet).
   3. Riser: Part #9C6R4-E3-08-RXA (violet).

2.3 COPPER BACKBONE CABLING

A. 25 Pair Copper backbone (Riser/Tie) telephone cabling shall be provided between MDF and IDF locations, continuous runs with no splices with ground shields at each end.
   1. Building Interior Locations:
      i. General Cable Corporation: CMR Category 3, 25 Pair, Part #2133033.
      ii. Hitachi Cable America, Inc.: Part #39228-50.
   2. Outside Plant (direct burial) Locations:
      i. General Cable Corporation: Part #PE89 Type, Category 3, 25 Pair, Part #7525785.
      ii. Superior Essex Cable: Caspic®-FSF RDUP PE-89, Cat 3, 25 Pair, Part # 09- 97-92.

B. Category 3 Cabling Electrical Characteristics:

Frequency	Ins. Loss	Next Loss	ACR	Structural Return Loss	Units
1	2.6	41.3	38.7	12.0	dB/100m
4	5.6	32.3	26.7	12.0	dB/100m
8	8.5	27.8	19.3	12.0	dB/100m
10	9.7	26.3	16.6	12.0	dB/100m
16	13.1	23.2	10.1	10.0	dB/100m

C. Multi-Pair Cable Specifications:
   1. Gage: 24 AWG.
   2. DC Resistance: 27.3W/1000’ (8.96W/100m), maximum.
   3. Mutual Capacitance (at 1khz).

4. Impedance: 100W (25 pair).
5. Buried/Underground Attenuation (db/1,000' [305m]) at 1.0 MHz: 6.4 (25 pair), maximum.
6. Aerial Cable Attenuation (db/1,000' [305m]) at 1.0 MHz: 6.7 (25 pair), maximum.

2.4 OPTICAL FIBER (Single mode) CABLING

A. Single mode Fiber Cable:
   1. Siemon Company:
   2. 12 Strand Part #: 9BB8R012G-E205A XGLO, Single mode, OS1/OS2, 8.3/125, Indoor, Tight Buffered, Non-Armored, OFNR, Yellow, Per Foot, North America.

2.5 OPTICAL FIBER (Multimode) CABLING

A. Multimode Fiber Cable:
   1. Siemon Company:
   2. 12 Strand Part#: 9BB5R012G-T512A XGLO, Multimode, OM4, 50/125, Indoor, Tight Buffered, Non-Armored, OFNR, Aqua, Per Foot, North America.

PART 3 – EXECUTION

3.1 PROJECT COORDINATION

A. Comply with Section 01 31 00 – Project Coordination. Contractor/CM shall coordinate and conduct meeting with cabling installer and affected trades to plan, organize and facilitate timely and orderly work to minimize project delay and work interference between trades.

B. Existing facility operations shall not be interrupted by communications installer's work activities. Active cable plant associated with specific work activities beyond construction area shall not be disrupted.

C. Circumstances (e.g., voice cutovers) that require service disruptions in existing facilities shall be scheduled with as much notice as possible. Service disruptions, if needed, shall be coordinated by Owner's Project Manager.

3.2 CABLING INSTALLATION

A. Work shall be installed per manufacturer's printed instructions to ensure certified channel solution.

B. Install plenum or riser cable types where indicated based on environmental conditions.

C. Horizontal cabling shall be terminated in IDF room on same floor as WAO's. Exceptions may be made if approved in advance by Owner's Project Manager.

D. Cables routed through floors (poke-thru, conduits, floor boxes, etc.) to utilize ceiling space on the level below may be routed to network room on adjacent floor (approved deviation from BICSI methodologies).

E. Install cables, WAO's, and network room equipment installation in accord with methodologies contained in latest BICSI Telecommunications Distribution Methods Manual and Information Transport Systems Installation 5th-Addition unless noted otherwise for cable attachments, firestopping, cable routing, equipment rack grounding & bonding, pulling tensions, and EMI protection methods.

F. Cable placement in conduit shall not exceed fill capacities per ANSI/EIA/TIA-569.

G. Smaller network rooms with cable tray extending directly from wall penetration to rack need not encircle room. Provide 5' (1.524m) cable service loop. Added cables shall follow established path.

H. Standard network rooms with cable tray encircling the room shall have at least 10' of service loop on the cable tray, prior to entering the vertical wire manager.

I. Provide 12” (305 mm) of service loop in in-wall, surface-mounted, and raceway boxes, provided manufacturer’s bend radius is not exceeded.

J. Provide at least 24” service loop at each outlet above ceiling.

K. Leave service loops at equipment cabinet (CP) locations to allow operation of equipment outside cabinets and allow full access to rear of cabinets when fully opened.

L. Each type of material (fiber optic cable, equipment rack components and termination hardware) shall be selected and installed to be compatible with manufacturer’s warranty.

M. Cables shall be one continuous piece without splices.

N. Cables may be installed within existing conduits, wire-ways or spaces if approved by Owner’s Project Manager, where cables do not exceed conduit or junction box capacity. Cabling components and faceplates shall be new.

O. Voice and data cables shall be color coded throughout building.

1. Standard voice cables: white.
2. Production data cables: blue.
3. Security and life safety cables: red or placed in red conduit.
4. Access control system cabling – yellow.
5. Security camera cables: orange.
6. Audio Enhancement amplifier data cables: violet.

P. Install pull strings with horizontal cables as cables are pulled.

Q. Installation of Cat 6 cabling in cable trays and vertical wire management should utilize a cable comb or similar tool to ensure neat, straight, and untangled installation.

R. Cable ties in cable tray shall not be used, except as needed to maintain bend radii when changing directions. Plastic cable ties shall not be used.

S. Install horizontal cable free of surface damage, kinks, twists, and with NO visible anomalies.

T. Any cable found with visible anomalies shall be replaced not at Owner’s expense, regardless of cable test results.

U. Cables shall be labeled and documented as specified in Section 27 05 53 – Identification of Communications Systems.

V. Copper horizontal cable lengths:

1. Horizontal cables from IDF room to WAO’s, shall not exceed 295’ (90 m).
2. Horizontal cables used for patch cords and cross-connect jumpers in MDF and IDF rooms, shall not exceed 15’ (4.88 m).
3. Total length for components shall not exceed 328’ (100 m).

W. Each horizontal data cable provided to individual WAO shall consist of 4-pair 100- ohm, Category 6, UTP cable.

X. Coordinate with other trades to complete work above ceilings and below raised floors prior to ceiling tile and floor panel installation.

Y. Cabling shall not be exposed, except when in cable tray or within IDF and MDF rooms. Raceway shall be used in corridors to individual spaces where conduit shall run perpendicular into spaces and to WAO locations.

END OF SECTION

SECTION 27 15 43 - COMMUNICATIONS FACEPLATES AND CONNECTORS

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. Wall outlet faceplates for single and multiple gang wall plates for wall and ceiling locations indicated to provide complete and functioning communications system.

1.2 REFERENCES

A. See Section 01 42 00 – References for additional reference standards, definitions, abbreviations, and acronyms.

B. National Fire Protection Association (NFPA): NFPA 70, National Electrical Code, 2020 Edition.

1.3 DESIGN REQUIREMENTS

A. Wall Outlets:

1. Communication outlets containing copper services shall be equipped with 8- position modular jacks (RJ45 type).
2. Communication outlets containing fiber services shall be equipped with LC type connections for multi-mode or single mode cabling terminations.
3. Outlet/connector box shall provide space for fiber cable connection with minimum 1.18” bend radius and 3.28’ cable coils for termination.
4. Outlet boxes where indicated shall be sized to accommodate both copper and fiber cabling.
5. Outlets shall consist of single and multiple outlets with corresponding sized wall plates as indicated. Provide blank module inserts for unused modules. Module types shall be as indicated.

B. Floor Outlets:

1. Multi-service floor outlets shall have single gang wall plate for communications inside floor box with blank module inserts for unused module locations.
2. No multi-service floor boxes shall be used in classroom locations.

C. Modular furniture outlets shall have modular furniture faceplate capable of housing four 8-position modular connectors, with blank module inserts for unused module locations.

D. Indoor outlets that require ruggedized outlets and all outdoor outlets shall use only outdoor-rated ruggedized outlets as specified below.

E. Surface mounted boxes and raceway outlets, power pole outlets and faceplates are only allowed for use in retrofitting existing facilities.

F. Four pair wiring assignments for modular jacks shall match patch panel wiring pin assignments and as indicated.

G. Outlet icon colors to be consistent with channel labeling on both ends.

H. See Section 27 05 53 – Identifications for Communications Systems for outlet labeling.

1.4 QUALITY ASSURANCE

A. Provide single channel solution for project with Siemens System 6 solution.

B. Systems installer shall be certified and trained by manufacturer to install listed products.

C. Installer shall maintain Registered Communications Distribution Designer (RCDD) on staff to supervise and direct installation.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's data sheets for specified products in accord with Sections 01 33 00 –Submittal Procedures.

B. Shop Drawings:

1. Provide scaled drawings (not less than 1/8" = 1'-0") indicating location and type/part number of faceplates to be used. Information may be included with submittal for drawing requirements required in Section 27 05 53 – Identification of Communications Systems.
2. Drawings shall show locations, mounting heights, and typical installation details for data outlets in each space.
3. Faceplates, connector modules, blank plates, specific outlet designator, wire and outlet type shall be identified and follow same nomenclature noted in Communications System Drawings.

C. Comply with Section 01 78 00 – Submittal Procedures for Project Record Drawings, Warranties, and other closeout documents.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with Section 01 66 00 – Product Storage and Handling Requirements.

B. Protect products from damage during delivery, storage, and installation. Replace damaged products at no added cost to Owner.

1.7 WARRANTY

A. Structured Cabling System (SCS) shall be provided by manufacturer for channel configuration including cable, jacks, patch cords, patch panels specifically approved for channel configuration with manufacturer's components.

PART 2 – PRODUCTS

2.1 FACEPLATES

A. Standard modular faceplates:

1. Siemon:
   a. 2-opening (D2): MX-FP-S-02-04 Faceplate, MAX, US, Single Gang, 2 Openings, MX, Gray
   b. 4-opening (D4): MX-FP-S-04-04 Faceplate, MAX, US, Single Gang, 4 Openings, MX, Gray
   c. 6-opening (D6): MX-FP-S-06-04 Faceplate, MAX, US, Single Gang, 6 Openings, MX, Gray
   d. Blank Insert, MX-BL-04, as needed.
   e. Outlet Type Designator: Siemon CT-FP-LBL-104 (10-8.5" x 11") label sheets with 100 color coded strips.
   f. Faceplate Label Covers: Siemon MX-FP-CVR-00 Bag of 100 clear rounded corner label covers for MAX faceplates.

B. Wireless access point boxes:

1. Siemon:
   a. 2-opening (D2WAP): MX-SMZ2-02 Surface Mount Box, MAX, 2 Openings, ZMAX, White.
   b. 4-opening (D4WAP): MX-SMZ4-02 Surface Mount Box, MAX, 4 Openings, ZMAX, White.

C. Standard surface mount boxes:
   1. Siemon: CT4-BOX-04, single gang.

D. Raceway faceplates and adapters:
   1. Wiremold 5000 series - Device Mounting Bracket with applicable hardware.
   2. Raceway parts as required by same manufacturer.

E. Modular furniture outlets:
   1. Siemon MX-UMA-01 Modular Furniture Adapter, MAX, Universal, 4 Openings, MX, Black
   2. Blank Insert, MX-BL-01, as needed.
   3. Outlet Type Designator: Siemon CT-FP-LBL-104 (10-8.5” x 11”) label sheets with 100 color coded strips.
   4. Faceplate Label Covers: Siemon MX-FP-CVR-00 Bag of 100 clear rounded corner label covers for MAX faceplates.

F. Indoor ruggedized and outdoor faceplates:
   1. Siemon: XFP-S-02-SS, Single gang faceplate, 2-port, stainless steel.

G. Indoor ruggedized and outdoor surface mount boxes:
   1. 1-gang non-metallic weatherproof box, various manufacturers.

2.2 CONNECTOR MODULES

A. Ultra MAX Cat 6 Modules:
   1. Siemon: Ultra MAX Model # U6-H04NS, Copper, Outlet, Ultra MAX, UTP, Category 6, RJ45, Hybrid, Gray, Punch down, T568A/B.
   2. Channel color icons are Siemon PN#: Z-ICON-(XX)-B, where (XX) is replaced by the color needed: 03 = Red, 06 = Blue, 07 = Green, 05 = Yellow, 09 = Orange, 08 = Violet

B. Indoor ruggedized and outdoor modules:
   1. Siemon: Model # XG2-Z6, Category 6 UTP Ruggedized G2 Z-MAX outlet, T568A/B.
   2. Provide Siemon Model # XG2-CAP Ruggedized G2 outlet dust cap with nylon retention tether for each outlet.

PART 3 – EXECUTION

3.1 PROJECT COORDINATION

A. Facility operations shall not be interrupted by communications installer’s work activities. Active cable plant associated with specific work activities beyond construction area shall not be disrupted.

B. Circumstances (e.g., voice cutovers) that require service disruptions in existing facilities shall be scheduled with as much notice as possible. Service disruptions, if needed, shall be coordinated by Owner’s Project Manager.

C. Work area outlets shall comply with ADA requirements for placement. Utility rooms and mechanical spaces are not required to follow ADA guidelines and locations shall be placed as indicated or as relocated in consultation with AE and Owner’s Project Manager.

3.2 FACEPLATE AND CONNECTOR INSTALLATION

A. Outlets shall be terminated to match patch panel pin/pair configuration. All four pairs shall be terminated.

B. Project in new facilities shall not use surface-mount boxes. In existing facilities surface-mounted boxes may be used if wall penetrations are not permitted.

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C. Install outlet modules where indicated. Immediately notify Contractor/CM of conditions preventing outlet box installation where indicated. Contact Owner's Project Manager if project has no Contractor/CM.

D. D2WAP and D4WAPs will use biscuit-style SM boxes as specified above, unless outdoor, coiled above finished ceiling no more than 18" above ceiling tile for easy access.

E. Provide and install blank modules in faceplates, as required. Cover outlet openings and shutters with masking tape if other construction is taking place in area. Tape shall be applied with sufficient pressure to ensure up to 60 days of adhesion. Tape shall not wrap around edges of faceplate or surface-mount box.

F. Indoor ruggedized drops shall be used in all kitchen areas, and any other areas as specified on plans.

G. Outdoor drops shall be used at any outdoor drop location on the plans, including for outdoor WAPS.

H. Install outlets in neat and professional manner per industry standards.

I. Label outlets as indicated and in accord with Section 27 05 53 – Identification for Communications Systems.

J. WAO's shall be installed per manufacturer printed installation instructions to ensure certified channel solution.

END OF SECTION

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SECTION 27 16 19 - COMMUNICATIONS PATCH CORDS, STATION CORDS, AND CROSS CONNECT WIRE

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. Stations cords, patch cords and connectors for communications cabling for communications system in sizes, types and locations indicated.

1.2 REFERENCES

A. See Section 01 42 00 – References for additional reference standards, definitions, abbreviations, and acronyms.

B. National Fire Protection Association (NFPA): NFPA 70, National Electrical Code, 2020 Edition.

1.3 QUALITY ASSURANCE

A. Comply with Section 01 45 00 – Quality Control.

B. Systems installer shall be certified and trained by manufacturer to install listed products.

C. Installer shall maintain Registered Communications Distribution Designer (RCDD) on staff to supervise and direct installation.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's data sheets for specified products in accordance with Sections 01 33 00 – Submittal Procedures.

B. Shop Drawings:

1. Provide scaled drawings (not less than 1/8" = 1'-0") indicating location and type/part number of faceplates to be used. Information may be included with submittal for drawing requirements required in Section 27 05 53 – Identification of Communications Systems.
2. Drawings shall show locations, mounting heights, and typical installation details for data outlets in each space.
3. Connector modules, specific outlet designator, wire and outlet type shall be identified and follow same nomenclature noted in Communications Symbol Legend on T-Drawings.

C. Comply with Section 01 78 00 – Submittal Procedures for Project Record Drawings, Warranties, and other closeout documents.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with Section 01 66 00 – Product Storage and Handling Requirements.

B. Protect products from damage during delivery, storage, and installation. Replace damaged products at no added cost to Owner.

1.6 WARRANTY

A. Structured Cabling System (SCS) shall be provided by manufacturer for channel configuration including cable, jacks, patch cords, patch panels specifically approved for channel configuration with manufacturer's components.

PART 2 – PRODUCTS

2.1 APPROVED MANUFACTURERS

A. The Siemon Company, Siemon Business Park, 101 Siemon Company Dr., Watertown, CT 06795-0400; Tel: 860-945-4200; Fax: 860-945-4225; Website: www.siemon.com.

B. Other manufacturers shall be approved, and products installed shall be warranted by Siemon in accordance with Section 27 05 00 – Common Work Results for Communications.

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2.2 MODULAR WORK-STATION CORDS

A. Provide one modular patch cord for each copper Cat 6 data channel at the WAO.

1. Siemon: Part #MC6-07-01 Work-Station Cords.

B. Provide one rugged-to-modular patch cord for all indoor ruggedized and outdoor data channels.

1. Outdoor WAPs: Siemon Part # XC6-03-B05T Category 6, UTP, Patch Cord, Ruggedized Plug-to-Modular RJ45 Plug, Black Cable w/Yellow Boot, Stranded, CM/CMX Outdoor, TPE.
2. Indoor kitchen workstation locations: Siemon Part # XC6-07-B05T Category 6, UTP, Patch Cord, Ruggedized Plug-to-Modular RJ45 Plug, Black Cable w/Yellow Boot, Stranded, CM/CMX Outdoor, TPE.

2.3 DATA PATCH CORDS

A. Provide one modular patch cord for each copper Cat 6 data channel used at patch panels in MDF and IDF locations indicated.

1. Data circuits - Siemon: Part #MC6-01-01 black.
2. Camera circuits - Siemon: Part #MC6-01-09 orange.
3. Audio enhancement amplifier circuits - Siemon: Part #MC6-01-08 violet.

2.4 FIBER OPTIC CONNECTORS

A. Fiber Optic Adaptor shall be Multimode LC, Angled adaptor, one piece construction.

B. These adapters are to be used to terminate riser fiber optic cable in the fiber tray in MDF and IDF locations.

C. Fiber adapters are to be fused, not mechanically connected.

D. Manufacturer:

1. Single mode: Siemon FC-F-LCU-29BL Fiber, Connector, Opti Fuse, Single mode, OS1/OS2, 8.3/125, LC UPC, Simplex, 250um,900um, Blue Boot, Blue Connector
2. Multimode: Siemon FC-F-LC5-29AQ Fiber, Connector, Opti Fuse, Multimode, OM4, 50/125, LC, Simplex, 250um,900um, Aqua Boot, Aqua Connector

2.5 FIBER OPTIC PATCH CABLES

A. Provide one duplex fiber patch cord for each duplex fiber channel installed.

1. Single mode: Siemon LBP-LCULCUL-03 Fiber, Jumper, Duplex, XGLO, Single mode, LC Blade Patch UPC, LC Blade Patch UPC, RFP, OS1/OS2, 8.3/125, Yellow, OFNR, 3 Meter; or LBP-LCULCUL-05 Fiber, Jumper, Duplex, XGLO, Single mode, LC Blade Patch UPC, LC Blade Patch UPC, RFP, OS1/OS2, 8.3/125, Yellow, OFNR, 5 Meter depending on distance needed for installation.
2. Multimode: Siemon LBP-LCLC5V-03AQ Fiber, Jumper, Duplex, XGLO, Multimode, LC Blade Patch, LC Blade Patch, RFP, OM4, 50/125, Aqua, OFNR, 3 Meter; or LBP-LCLC5V-05AQ Fiber, Jumper, Duplex, XGLO, Multimode, LC Blade Patch, LC Blade Patch, RFP, OM4, 50/125, Aqua, OFNR, 5 Meter depending on distance needed for installation.

PART 3 – EXECUTION

3.1 PROJECT COORDINATION

A. Facility operations shall not be interrupted by communications installer’s work activities. Active cable plant associated with specific work activities beyond construction area shall not be disrupted.

B. Circumstances (e.g., network/voice cutovers) that require service disruptions in existing facilities shall be scheduled with as much notice as possible. Service disruptions, if needed, shall be coordinated by Owner's Project Manager.

C. Work area outlets shall comply with ADA requirements for placement. Utility rooms and mechanical spaces are not required to follow ADA guidelines and locations shall be placed as indicated or as relocated in consultation with AE and Owner's Project Manager.

END OF SECTION

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SECTION 27 18 00 - COMMUNICATIONS TESTING

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. System validation testing for voice and data communications cabling and connecting hardware for verification that structured cabling system has been installed properly and performs as specified.

B. Communications system validation testing shall in accord with ANSI/TIA 568.B.1, for Category 6 Structured Cabling System (SCS).

1.2 QUALITY ASSURANCE

A. Comply with Section 01 45 00 – Quality Control.

B. Installed voice and data communications systems to verify that cable has been installed and functions properly.

C. Perform validation testing on horizontal and backbone cabling testing in accord with ANSI/TIA/EIA-568-B.1 and CAT6 addendum for copper cabling.

D. Third Party Testing: Owner may elect to employ independent testing and certification firm to provide testing of all or part of Structured Cabling System.

E. SCS installer shall set wiring tester for channel configuration for data which includes patch cord, patch panel, UTP Cable, work-area jack, and work area cord, with permanent link configuration for voice.

F. SCS installer's RCDD shall sign off on copper and fiber optic cable test results, indicating that cable testing procedures and cable testing is in compliance with contract documents and referenced standards.

1.3 SUBMITTALS

A. Comply with Section 01 33 00 – Submittal Procedures.

B. Comply with Section 01 78 00 – Closeout Submittals.

C. Provide list of test equipment proposed for certification testing for review prior to testing.

D. Provide names of personnel performing testing. Personnel shall have attended training program in operation of specified manufacturer's equipment and shall provide certificates demonstrating successful completion of training.

E. Test Results:

1. Provide Owner's Project Manager with printed and electronic forms of test results as noted in Part 3 Execution.
2. Test results shall be unedited and as presented by tester's software. Provide software from tester's manufacturer with test results to enable viewing of test results in native format.

1.4 PROJECT CONDITIONS

A. Owner reserves right to be present during testing.

B. For additions and renovations to existing occupied facilities, testing of existing and active connections is likely to be restricted until after normal working hours. Owner's Project Manager will determine if testing can occur during normal business hours.

C. Testing shall occur only after channel is installed. If channel components are moved or re-positioned after testing, retest cables, faceplates, and other components in final position.

1.5 WARRANTY

A. Warranty: Comply with Section 27 05 00 – Common Work Results for Communications, Para. 1.9.

B. Manufacturer shall provide 20-year Channel Performance Warranty for complete communications system.

1. System shall be Siemon System 6 solution.
2. Manufacturers shall warranty worst-case performance data for installed cabling system, and performance data indicated in warranty documents/certificate.
3. Twenty (20) year warranty for Cat 6 structured cabling system shall provide for end-to-end channel model installation which covers applications assurance, cable, connecting hardware, and labor cost for repair or replacement.
4. Warranty shall indicate compliance with margin claimed by manufacturers over Cat 6 channel specifications on transmission parameters across entire frequency range of 1-250 MHz as indicated in manufacturer's catalogs and product literature.

C. SCS installer shall provide 3-year warranty for communications system installation to include materials and labor warranty for replacement of defective installation or equipment including cables, jacks, patch cords, patch panels, devices, and cabling.

D. Date of warranty period shall begin from date of project's substantial completion.

PART 2 – PRODUCTS

2.1 APPROVED TESTING EQUIPMENT

A. Testers as approved by The Siemon Company.

PART 3 – EXECUTION

3.1 GENERAL

A. Owner reserves right to be present during testing.

B. Provide required test equipment and personnel necessary to support certification and validation tests indicated and in accord with Section 01 45 00 – Quality Control.

C. All elements of the test ran on each channel must be in a passing condition on the tester.

D. Test result shall indicate compliance with margin claimed by manufacturer over Cat 6 channel specifications for frequency range of 1-250 MHz as indicated in manufacturer's catalogs and product literature.

3.2 COPPER TESTING EQUIPMENT

A. Balanced twisted-pair field testers shall be factory calibrated each calendar year by field test equipment manufacturer as stipulated by manuals provided with field test unit. Calibration certificate shall be provided to Owner's Project Manager for review prior to start of testing.

B. Set testers to correct cable, by manufacturer and name, to ensure correct parameters are used during testing. Test settings selected from options provided in field testers shall be compatible with installed cable under test.

3.3 CATEGORY 6 TESTING

A. Category 6 testing shall be performed with approved Level III balanced twisted-pair field test device. Scanners shall be in good working order with current calibration stickers from manufacturer's approved calibration facility.

B. Installed Category 6 channels shall comply with ANSI/TIA/EIA standards or use cable manufacturers test standards to certify total solution installed, if more stringent.

C. Category 6 balanced twisted-pair horizontal and backbone cables shall not exceed 90 m (295 ft) for basic link, and 100 m (328 ft) for channel shall be 100 percent tested in accord to ANSI/TIA/EIA-568-B.2.

D. Provide test results indicating CAT 6 cable tests in text files on flash drive(s), and two print copies in 3-ring binders. Provide text files for each building. Each test page shall be separated by standard page break (one test per page).

E. Cat 6 Channel Performance Testing Requirements shall meet or exceed the specifications of the manufacturer of the cable.

F. Calculations shall be derived from tests and provide results for following:

1. Continuity.
2. Polarity checks.
3. Wire map.
4. Attenuation.
5. PSNEXT.
6. ACR.
7. Installed length of CAT 6 cable.

G. Correct cable NVP shall be entered into test equipment to ensure proper length and attenuation readings. Cables not in accord with EIA/TIA 568B, Category 6 tests shall be identified to AE and RCDD for corrective action. Cable replacement shall be at no additional cost to Owner.

H. Data jacks in each outlet shall be tested for CAT 6 compliance in channel configuration to verify integrity of conductors and correctness of termination sequence indicated.

I. Prior to testing UTP runs, test equipment shall be calibrated per manufacturer's printed guidelines. Correct cable NVP shall be entered into test equipment to ensure proper length and attenuation readings.

3.4 FIBER OPTIC TEST EQUIPMENT

A. Optical fiber test equipment shall be factory calibrated each calendar year as recommended by field test equipment manufacturer. Manufacturer's calibration certificates shall indicate equipment name and serial number and shall be provided for review prior to start of testing.

3.5 OPTICAL FIBER CABLING TESTING

A. Optical fiber horizontal and backbone cabling shall be verified in accordance with ANIA/TIA/EIA-568-B.1 with Addendum for fiber optic cabling testing.

B. Each strand in fiber optic cables shall be tested for correctness of termination, overall transmission loss, and defects using approved Optical Time Domain Reflectometer (OTDR) and power meter.

C. Tests shall be performed for reach stand of fiber in two-way averaging measurement of fiber. Engineer of record shall be notified at least one week prior to testing to allow his observation of testing optical fiber strands for insertion loss and length and bi-directional OTDR tests on OSP optical fiber strands.

D. Test for insertion loss at 850 nm for multimode cabling per TIA/EIA-526-14 method B, one jumper reference. System loss measurements (both calculated and measured) shall be provided for 50/125mm multimode cabling in at least one direction.

E. Test for insertion loss at 1310 nm and 1550 nm for single mode cabling in at least one direction using Method A.1 (1-jumper) test procedure as specified in ANSI/TIA/EIA-526- 7.

F. Acceptable losses shall calculate allowable attenuated loss based on manufacturer specs, final installed length, attenuation coefficient, and connector loss.

G. Test Reports:

1. Certification report shall be provided listing both calculated and measured loss for each fiber optic strand and submitted with test results as noted above. Cable lengths shall be verified with OTDR.
2. Provide test results indicating fiber optic cable tests in text files on flash drive(s), and two print copies in 3-ring binders.
3. Test results shall be unedited and as presented by tester's software. Supplemental summaries may be provided to Owner's Project Manager. Provide Fiber performance calculation worksheets and fiber link attenuation records as illustrated in Section 21 (Figures 21.14 and 21.15) of BICSI Telecommunications Cabling Installation Workbook, Technician, 2nd Edition.
4. Test reports shall indicate fiber wavelength, fiber and cable manufacturer's part numbers, type, attenuation, bandwidths specifications, and measurement direction.

H. Test optical fiber strands for insertion loss and length. Perform bi-directional OTDR tests on OSP optical fiber strands. OTDR trace(s) shall be in project closeout submittals.

I. Calculate allowable attenuated loss based on final installed length, attenuation coefficient, and connector loss.

J. Immediately remediate strands testing above calculated limits.

K. Owner reserves right to have third party testing to confirm test results. Remediate, at Contractor's expense, strands exceeding calculated limits by third party testing.

3.6 COMMUNICATIONS AND GROUNDING SYSTEM TESTING

A. See Section 27 05 26 – Grounding and Bonding for Communications Systems.

B. Testing shall be performed for impedance of bonds of grounding system, including cable armor bonding to ground. Impedance of two-point bonding test across any bond shall not exceed 0.1 ohm. Remediate bond(s) over limit or which contribute to total impedance exceeding 0.1 ohm from any point in network room to busbar in that room.

C. Bonds installed shall be tested for impedance with earth ground resistance test in its two- point setup with approved tester. Place QA label (with date and inspector) in proximity to each bond tested.

D. Test grounding conductors, once installed, for current. Measure AC and bi-directional DC current. Report AC current over 1 Amp. Report any DC current, in either direction, over 500 milliamps.

END OF SECTION

SECTION 27 21 33 - BIDIRECTIONAL ANTENNA SYSTEM INSTALLATION (RADIO AND CELLULAR)

PART 1 – GENERAL

1.1 SUMMARY

A. Provide and install a bi-directional antenna (BDA) and distributed antenna system (DAS) to enhance in-building radio coverage for emergency responders and in-building cellular/LTE coverage for general use. The system shall ensure compliance with Florida Statute 633.202 and the Florida Fire Prevention Code and meet NFPA 1225 (2022) requirements for Emergency Responder Communications Enhancement Systems (ERCES). The installation must also adhere to applicable cellular provider requirements and FCC regulations. The design shall integrate public safety radio and commercial LTE systems while maintaining isolation between them to prevent interference, thereby protecting the integrity of the emergency responder radio communications.

1.2 REFERENCES

A. The installation shall comply with the latest editions of the following codes and standards (including local amendments):

1. Florida Fire Prevention Code (FFPC) and Florida Statute 633.202 (requiring in- building public safety radio coverage)
2. NFPA 72 – National Fire Alarm and Signaling Code (for monitoring and alarm integration)
3. NFPA 1225 (2022) – Standard for Emergency Services Communications (supersedes NFPA 1221; governs ERCES design, installation, and performance)
4. International Fire Code (IFC) Section 510 – Emergency Responder Radio Coverage (as applicable by AHJ)
5. UL 2524 – Standard for In-Building 2-Way Emergency Radio Communication Enhancement Systems (equipment listing standard)
6. FCC CFR Title 47, including Part 90 (Public Safety Land Mobile Radio) and applicable Parts 20/22/24/27 (Commercial cellular bands) – regulations for signal booster use and licensing.

1.3 SUBMITTALS

A. Product Data: Manufacturer’s data sheets for all components (BDAs, DAS head-end equipment, antennas, cabling, battery backup, etc.), showing compliance with NFPA 1225 and UL 2524 listing.

B. System Design Drawings: Floor plans and riser diagrams showing DAS antenna locations, cable routes, BDA/DAS equipment locations, donor antenna placement, and calculated donor-to-coverage antenna isolation values. Indicate how public safety and commercial cellular systems are separated or integrated (e.g. separate coax runs or combined neutral-host DAS) while meeting isolation and filtering requirements.

C. Coordination Approvals: Evidence of coordination with the AHJ and frequency license holders. This includes written approval or permits from the Authority Having Jurisdiction (Fire Marshal / Radio System Administrator) and the license holder for the public safety radio frequencies, as well as documentation of consent or pre-approval from any commercial wireless carriers whose signals will be amplified (or from a neutral-host DAS provider acting on their behalf). If required by FCC rules for wideband signal boosters, provide proof of FCC Signal Booster Registration or license.

D. FCC Equipment Certifications: FCC grant of certification (FCC ID) for each RF-emitting device (BDAs/boosters) to be used, demonstrating they are certified for their respective frequency bands (e.g. Part 90 for public safety, Part 20/22/24 for cellular).

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E. Test Reports (Pre-Installation): Baseline radio signal strength survey of the building (if available) to document existing coverage. Post-installation test plans, including grid test procedures for signal levels and Delivered Audio Quality (DAQ) verification.

F. Operations and Maintenance Manuals: Complete O&M documentation for the system, including equipment manuals, programming/configuration settings, battery calculations, and recommended maintenance procedures. Also include a copy of the manufacturer's UL 2524 certification for the equipment.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: The installer shall be factory-certified by the BDA/DAS equipment manufacturer and have a minimum of 10 years of experience designing and installing public safety radio enhancement systems and cellular DAS. Personnel shall be knowledgeable in NFPA 1225 code requirements and possess any necessary FCC licenses or industry certifications for RF systems integration.

B. Regulatory Compliance: All equipment and installation methods shall strictly conform to NFPA 1225 (2022) requirements for in-building emergency communications systems. This includes meeting minimum coverage percentages, signal quality (DAQ) levels, isolation margins, and monitoring/alarming as specified in NFPA 1225 Chapter 18. The system design and components shall also comply with IFC Section 510 and local amendments as enforced by the AHJ.

C. Listings and Certifications: All RF-emitting devices (BDAs, amplifiers, remote units) and system components shall be FCC certified, and UL 2524 listed for public safety use. The system shall utilize equipment specifically designed for ERCES applications (NEMA 4 or 4X enclosures if required for device protection in non-conditioned or potentially wet locations). All cable used shall be UL-listed for its purpose (e.g. plenum-rated coaxial cable per NFPA and fire code).

D. AHJ Approval: The system design, including layout and operational parameters, must be reviewed and approved by the AHJ prior to installation. The contractor shall coordinate with the AHJ's representative (e.g. fire radio communications officer) for any required field inspections. Installation of the BDA/DAS shall not begin until the necessary permits are obtained. Final system acceptance is contingent on passing all AHJ witnessed tests and inspections.

1.5 WARRANTY

A. Provide a minimum three-year warranty on all parts and labor for the BDA/DAS installation. The warranty shall cover all components of the system (amplifiers, power supplies, antennas, cables, etc.) against defects in materials and workmanship. In addition, offer an optional extended maintenance agreement for years 5 and beyond, which includes periodic testing (annual or per code requirements) and on-call support to ensure continued compliance with NFPA 1225 and carrier specifications.

PART 2 – PRODUCTS

2.1 SYSTEM COMPONENTS

A. Provide a complete Bidirectional Amplifier and Distributed Antenna System with components including, but not limited to, the following:

1. Public Safety Band BDA (Radio Repeater): A bi-directional amplifier dedicated to public safety radio frequencies. The unit shall be a Class A (channelized) amplifier as required by the AHJ and radio system license holder. It shall support all necessary uplink and downlink frequencies in the 700 MHz and 800 MHz public safety bands used by the jurisdiction (for example, 769–805 MHz and 806–869 MHz ranges). The amplifier shall have gain and output power appropriate for the size of the building and desired coverage, but not excessive (to avoid noise/interference issues). The BDA enclosure shall be UL 2524 listed, NEMA 4-rated for durability and fire protection if not installed in a 2-hour-rated equipment room, and suitable for indoor installation (temperature and humidity ranges consistent with building conditions). The public safety BDA must include sharp filtering to ensure only

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public safety frequencies are amplified, preventing any interference to or from commercial cellular bands. It shall be equipped with oscillation detection and automatic shutdown features per FCC requirements to prevent interference outside the building.

2. Commercial Cellular/LTE BDA or DAS Head-End: A multi-band signal booster or Distributed Antenna System head-end unit to support commercial wireless services (LTE, and legacy cellular). The system shall support the major cellular frequency bands including 700 MHz (LTE Band 13/14/12 for Verizon/FirstNet/AT&T), 800 MHz cellular band (e.g. Band 5), 1900 MHz PCS (Band 2/25), 2100 MHz AWS (Band 4/66), and additionally provide support or upgrade paths for 3550–3700 MHz CBRS band if the District or carriers intend to use private LTE/5G in that band. The DAS equipment shall be carrier-approved (or vendor has blanket carrier approvals) and FCC certified for operation on all supported bands. It shall be software configurable to only amplify or retransmit the specific carriers/frequencies in use, with appropriate band filters to avoid interference with the public safety BDA. The cellular BDA/DAS head-end shall be modular and scalable for future technology or band additions (e.g. support for new 5G bands) and housed in a NEMA-rated enclosure. All cellular amplification equipment must meet network protection standards of the wireless carriers (e.g. oscillation sensing, noise floor control) and, if using a wideband amplifier, be registered with the FCC and operated with consent of the licensees (the carriers).
3. Donor Antennas: Donor antennas for receiving the signals from the radio system and cellular networks. Provide separate donor antennas for the public safety BDA and for the cellular DAS, in order to maintain isolation and prevent intermodulation between the two systems. The public safety donor antenna shall be a directional Yagi or similar high-gain, narrow-band antenna tuned to the public safety frequencies. The cellular donor antenna may be a log-periodic or broadband directional antenna covering the cellular bands of interest, or multiple antennas if different bands are best served by separate antennas. Mounting: Donor antennas shall be installed at a location and height that provides a clear line-of-sight to the serving radio tower or cell site. They should be mounted with adequate physical separation from any in-building coverage antennas to meet the required isolation of at least 15 dB above the BDA gain (this typically entails vertical separation on the order of tens of feet or building floors, as well as horizontal spacing). The two donor antennas (radio and cellular) should also be spaced apart from each other to avoid cross-coupling; a minimum of 10 ft horizontal and/or 5 ft vertical separation is recommended, subject to isolation testing results. Donor antennas shall be rated for outdoor use, with wind loading and lightning protection appropriate for the site (include lightning arrestors on coaxial feeds per code). Maximum donor antenna gain should not exceed what is necessary for good donor signal quality (per AHJ guidance, e.g. use ≤11 dBi gain unless higher is justified).
4. Coverage Antennas (Indoor DAS Antennas): Low-profile, broadband omnidirectional antennas (or directional antennas as needed for specific areas) to rebroadcast signals inside the building. Ceiling-mounted omni antennas are typical for general coverage. The quantity and placement of indoor antennas shall be determined by predictive RF design to achieve ≥95% floor area coverage throughout the building and 99% coverage in critical areas (stairwells, elevators, emergency command areas, etc.). Antennas should be broadband to support both public safety and cellular frequencies, but if the system design keeps public safety and cellular distribution separate, then dedicated antennas for each system may be used (e.g. a separate antenna in the same area for 700/800 MHz public safety and another for cellular bands) to optimize performance and isolation. All indoor antennas shall be UL listed for plenum installations and comply with building aesthetic requirements.
5. DAS Distribution Cabling and Components: Provide all necessary coaxial cabling, splitters, couplers, hybrid combiners, fiber optic links, and associated hardware to form a complete in-building DAS. Coaxial cables shall be plenum-rated, low-loss coax (e.g. LMR-400, LMR-600 or equivalent, depending on length and loss budget) for runs within the building. Use

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broadband or band-specific splitters and couplers to divide and route signals as designed. Where distance or building layout necessitates, an Active DAS approach using fiber optic remotes is acceptable: fiber DAS components (head-end, remote units, etc.) must be UL 2524 listed if carrying public safety signals. Ensure any active DAS amplification for public safety is battery-backed and supervised similar to the BDA. All RF connectors shall be high quality and properly installed to minimize VSWR; perform sweep/PIM testing on coax and antennas to verify integrity. Label all cables and antennas with their function (e.g. “Public Safety DAS – 800MHz”). Maintain separation between public safety coax and other signal cables as needed to avoid interference (or use cross-band couplers with high isolation when combining paths).

6. Power Supplies and Battery Backup: Provide a dedicated 120V AC primary power circuit for each active equipment location (BDA and any DAS head-end or remote amplifiers), drawn from the building’s emergency electrical panel if possible (to prioritize restoration). The primary power circuit shall be on an emergency or UPS power source if available and shall be permanently connected and protected (installation to comply with NFPA 72 Chapter 10 requirements for primary power). For secondary power, provide a battery backup system dedicated to the BDA/DAS that can support 12 hours of operation at 100% capacity in the event of power failure. The battery system shall include a charger and automatic switchover. Batteries must be sealed lead-acid or lithium type designed for standby use, with sufficient amp-hour capacity to meet NFPA 1225 runtime (12 hours) at the full system load (all amplifiers active). As an alternative (if approved by the AHJ), a 2-hour minimum battery combined with connection to the building’s emergency generator is acceptable, provided the generator can support the BDA/DAS load for at least 12 hours. House the batteries in a UL-listed enclosure (if not part of the BDA unit enclosure) and include temperature compensation for charging. The entire power supply and charging system shall be supervised for AC failure and charger failure with signals to the fire alarm panel.

2.2 SYSTEM DESIGN AND INTEGRATION

A. DAS Architecture: The in-building coverage system may be implemented as a Passive DAS, an Active DAS, or a hybrid combination, appropriate to the facility size and layout. A passive DAS (coax-based) is generally suitable for small to medium buildings, using coax splitters and tappers to distribute the signal. An active or fiber DAS (with distributed remote units) may be used for larger campuses or where coax losses would be excessive. The design shall ensure that sufficient signal is delivered to all areas while meeting the NFPA 1225 performance criteria (signal strength and quality). Regardless of architecture, public safety signals and commercial cellular signals must be managed to prevent mutual interference. If a shared antenna network is used for both, appropriate combining equipment (duplexers, band-pass filters, isolation couplers) must be installed to keep the public safety band isolated from the cellular bands.

B. Separation of Public Safety and Commercial Services: In accordance with best practices for ERCES integration with cellular DAS, the system must maintain the ability to independently control and shut down the commercial cellular portion without affecting the public safety radio portion. Public safety communications shall have priority and must remain operational during emergencies even if the cellular DAS is shut down or malfunctioning. To achieve this, the design may use physically separate infrastructure for public safety vs. commercial signals (separate donor antennas, dedicated BDAs, and possibly separate indoor antenna runs). If any common elements (e.g. shared coax runs or antennas) are used for both services, the integrator shall demonstrate to the AHJ that loss of the commercial equipment or any interference will not degrade the public safety radio coverage below code requirements. Filtering: All active RF amplifiers shall include band-specific filtering. The public safety BDA must reject out-of-band signals (including cellular) to avoid overload, and the cellular DAS equipment should likewise filter out public safety frequencies except on the path specifically intended for them. This separation of bands is critical to prevent intermodulation and to comply with FCC emission limits for each service.

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D. Interference and Noise Control: The system shall be designed such that the noise floor on the public safety frequencies inside the building does not rise to a level that would compromise inbound (uplink) communications to the radio system. This typically means using a channelized (Class A) BDA if the RF environment has strong adjacent-channel signals, or using isolation filters between the public safety and cellular systems. The cellular DAS amplifiers should have built-in oscillation detection and noise limiting features as required by FCC. The overall design should ensure that combining the two systems (if done) does not produce intermodulation products. For example, if high-power cellular signals are present, their amplifiers should not intermix with the public safety donor; a neutral host DAS head-end often includes a master unit per carrier which can be isolated from the public safety BDA. All these measures act as co-location safeguards to allow public safety and commercial services to coexist without degradation.

E. Coverage Requirements: The installed system shall achieve radio signal coverage and quality per NFPA 1225 specifications. This means a minimum of 95% floor area coverage for general building areas and 99% coverage in critical areas (e.g. fire command centers, exit stairwells, corridors, pump rooms) with the required signal strength or intelligibility. Signal strength should be sufficient to provide a Delivered Audio Quality (DAQ) of 3.0 (intelligible voice) for public safety communications throughout the coverage area. For systems carrying public safety LTE (FirstNet Band 14) or other broadband data used by responders, the design should likewise ensure adequate SINR (Signal to Interference & Noise Ratio) for reliable data throughput. The cellular coverage should meet the benchmarks agreed upon with the carriers or owner (typically >= –95 dBm RSRP for LTE signals for major carriers in most areas). The design shall include a margin to account for building attenuation and future changes (target an extra safety margin of at least 10 dB above the minimum where feasible).

F. AHJ and Carrier Coordination: The system design and component selection must be coordinated with both the AHJ (for public safety) and the commercial wireless carriers (for cellular). Public Safety: Coordinate with the county/city radio system administrator to obtain the exact frequencies and channel details to be amplified, and to ensure the BDA settings (gain, donor antenna direction) are compatible with the radio network. Obtain any required permit or frequency authorization letter from the license holder of the public safety frequencies. Cellular: Engage with the wireless carriers (Verizon, AT&T, T-Mobile, etc.) early in the design. If a neutral-host DAS provider is involved, their engineering guidelines should be followed. If using carrier-specific BBUs or donor feed agreements (e.g. carrier-provided small cell feeding the DAS), include those in the design. At minimum, written consent or acknowledgement from each carrier whose frequencies will be rebroadcast is required, per FCC and carrier network protection policies. All cellular signal boosters must either be of a type that is pre-approved by the carriers or individually registered and coordinated. The installer shall ensure compliance with any carrier-specific design thresholds (for example, maximum allowable noise contribution back to the macro network).

PART 3 – EXECUTION

3.1 INSTALLATION

A. General Installation Practices: Install all system components in accordance with the manufacturer’s instructions, relevant NEC and NFPA codes, and industry best practices for RF systems. Use proper tools and techniques for coax cable installation (bend radius, support, grounding) to maintain cable performance. All equipment shall be mounted securely (e.g. BDA enclosure bolted to wall or rack, antennas firmly attached to structure). Adhere to OSHA safety standards when working at heights (roof or ceiling spaces) for antenna and cable installation.

B. Equipment Placement: Mount the BDAs and any active DAS electronics in an accessible location, such as a dedicated telecommunication room or electrical room, ideally with a 2-hour fire rating or protection (per fire code for critical emergency communication equipment). If such a room is not available, ensure the BDA enclosure itself is NEMA 4 and install it in a low-risk area away from heat, moisture, and tampering. Provide the required clearances around

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equipment for service and ventilation as specified by the manufacturer. Prominently label the BDA/DAS cabinet: “Emergency Responder Radio System” and include the NFPA 1225-required signage (e.g. UL 2524 label, identification of donor site frequencies, and control panel location if remote annunciator is used).

C. Antenna Installation: Install donor antennas on the roof or high point of the building using a secure mounting mast or bracket. Aim the public safety donor antenna toward the donor radio site as instructed by the radio system authority. Aim the cellular donor antenna(s) toward the strongest serving cell sectors for each carrier (or as directed by carrier RF engineering). Verify that the mounting location yields adequate donor signal levels but also minimizes pick-up of unwanted signals (noise or other radio systems). Ground each donor antenna mast and coax with lightning protection devices per NEC Article 810. Inside the building, mount coverage antennas per the design drawings. Where ceiling grid mounts are used, ensure the ceiling can support the antenna or provide independent support wires. Maintain the design-specified distance of antennas from building occupants (some high-gain antennas have minimum distance for RF exposure – follow manufacturer guidelines). Critically, maintain separation between donor and indoor antennas as designed to meet or exceed the 20 dB isolation margin; after installation, perform an isolation test (with a service monitor or spectrum analyzer and a test transmitter) to confirm this isolation before activating the amplifiers. Adjust antenna placement or add attenuation/load as needed if isolation is insufficient.

D. Cable Routing and Grounding: Route RF cables through dedicated (not shared with structured cable plant or any other circuit) conduits or cable trays as feasible. All penetrations of fire-rated walls or floors for cabling must be properly sleeved and fire- stopped per code. Coaxial cables should be kept at least 2 ft away from high-voltage power cables to reduce noise coupling. Where public safety and cellular coax cables run in parallel, maintain some physical separation or use segregated pathways to avoid intermodulation. Ground the cable shields and connector surge protectors to the building’s grounding system at the BDA enclosure entry (single-point ground). Install a ground bar if needed to terminate all grounds at the BDA/DAS location. The donor coax should have a lightning surge protector installed at the entry point to the building, grounded per NEC.

E. Interference Mitigation: During installation, take care to avoid creating any RF feedback loops. Do not power on the BDA until all antennas are connected and isolation testing is done (to prevent oscillation). If any feedback or oscillation alarm occurs on power-up, immediately shut down and re-check antenna separation and cable connections. Ensure that the public safety BDA’s gain settings are adjusted such that the output signal levels will not overwhelm nearby receivers (including the cellular DAS front-end). Use manufacturer-recommended settings or commissioning software to set gain/channel levels for each band. If the building has other RF systems (Wi-Fi, private radio, etc.), ensure not to co-locate BDA antennas too closely to those antennas to avoid inter- system interference.

3.2 TESTING AND COMMISSIONING

A. Component Testing: Before full system turn-up, test all coaxial cable runs with a spectrum analyzer or cable analyzer (sweep test) to verify low VSWR and insertion loss as designed. Test each donor antenna feed line for proper isolation and expected signal strength from donor source. Verify that each amplifier unit powers on and that alarm circuits (supervisory outputs) function. Measure the donor signal levels and set initial BDA gain values accordingly (taking care not to over-drive).

B. Coverage Performance Testing: Conduct a thorough coverage test upon installation completion. This should be done in the presence of the AHJ or their representative. Perform a grid test of the building: divide each floor into small test sectors (e.g. 20 ft x 20 ft grid) and measure the downlink signal levels and quality in each. For public safety frequencies, use appropriate test equipment (spectrum analyzer) to measure received signal strength (in dBm) and, if possible, Delivered Audio Quality (DAQ) by doing a radio communication test. Per NFPA 1225, general areas must show at least 95% coverage at the required signal level/quality, and 100% of critical

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areas at the required levels. Document all test results. In addition to signal level, verify intelligible voice communication using the public safety radios in multiple areas (the standard is DAQ 3.0 minimum intelligibility). Likewise, test the uplink by verifying that a responder's portable radio can transmit out to the radio system (often done by measuring RSSI at the donor site or having dispatch confirm clarity from inside). For the cellular DAS, perform a walk test using carrier-specific tools or phones to check that strong LTE signals are present in all intended areas, though the primary focus is on public safety coverage.

C. Isolation and Oscillation Test: As part of acceptance testing, perform a formal isolation test between the donor and indoor antennas. This involves injecting a test signal from one antenna and measuring at the other to ensure that isolation exceeds amplifier gain by >15 dB margin. If the public safety radio licensing authority (e.g. County Radio Division) requires a witnessed test, coordinate scheduling with them. Document the measured isolation value (in dB) and ensure it meets the requirement with margin. Also verify that when the BDA is turned on, no oscillation alarms trigger and no feedback is observed on the spectrum analyzer.

D. System Monitoring and Alarms: Test all supervisory alarm functions per NFPA 1225 requirements. Simulate a primary power failure (disconnect AC to the BDA/DAS) and verify the system switches to battery smoothly and that a "AC Power Fail" trouble signal is sent to the building fire alarm panel. Simulate a charger failure (if possible, by disabling the charger) to trigger that alarm. Disconnect or power-down a critical component to simulate an amplifier failure; verify that an alarm is reported for booster failure. All these supervisory signals must annunciate on the building's fire alarm system per NFPA 72 (either as distinct points or a general trouble, as allowed by code). Also verify the remote annunciator panel (if provided) visibly and audibly indicates these faults. Work in conjunction with the District's preferred fire alarm vendor to ensure alarm tie-in is functional.

E. Acceptance and Documentation: After all testing indicates compliance, schedule a formal acceptance walk-through with the AHJ and owner. Provide them with a test report binder showing the floor plan with test points, signal level readings, isolation measurement, and a signed letter by a responsible RF engineer certifying that the system meets NFPA 1225 and local requirements. Obtain written approval/sign-off from the AHJ as required. Additionally, any necessary documentation for the carriers should be completed – for example, close out any carrier coordination agreements or register the booster with the carrier's databases if required. Turn over copies of all as-built drawings, antenna locations, attenuation settings, and equipment configurations to the owner for their facility records.

3.3 TRAINING

A. Once the system is operational and accepted, provide training to designated Martin County School District personnel (e.g. IT/telecom staff and facilities management). Training should include:

1. System Overview: Explanation of the BDA/DAS architecture, including identification of the public safety vs. cellular components, location of donor antennas, and how the system interfaces with the fire alarm (for monitoring).
2. Operational Procedures: Instruct staff on how to silence or acknowledge alarms on the BDA system, and the procedure to follow if a trouble alarm occurs (who to notify, etc.). Provide guidance on not powering off the system except in an emergency or with AHJ coordination. Explain any periodic tasks, such as checking the battery status indicators.
3. Maintenance and Testing: Review the routine inspection requirements per code – e.g. annual testing of signal strength and battery load tests as required by NFPA 1225 and local ordinances. Provide a schedule or checklist for maintenance. Train staff on basic troubleshooting: checking LED indicators on the BDA, ensuring donor antenna has line- of-sight (no new obstruction), etc. Advise that qualified personnel must perform any modifications or repairs.

4. Documentation and Contacts: Hand over the O&M manuals and as-built documentation. Point out the signage posted with system information (frequencies, etc.). Provide contact information for the installation contractor or maintenance service provider for future support. Ensure the staff know to inform the AHJ if the system is going to be shut down for any reason or if building renovations might affect coverage. Emphasize that the BDA/DAS is part of life-safety systems in the building, and therefore any issues must be addressed promptly to remain in code compliance.

3.4 COORDINATION AND APPROVALS

A. Throughout the project, maintain close coordination with all stakeholders:

1. Authority Having Jurisdiction (AHJ): Comply with all plan review comments and inspection requirements from the Fire Marshal (or relevant AHJ). Notify the AHJ well in advance of testing dates, as their presence may be required for the final acceptance test. Incorporate any additional local requirements not explicitly covered in this specification (for instance, some jurisdictions require a specific donor antenna mounting method or a lockable NEMA enclosure, etc.). Provide the AHJ with access to the BDA location and controls during inspections. Final acceptance must include AHJ sign-off that the system meets NFPA 1225 performance standards and local ordinances.
2. Public Safety Radio License Holder: In Martin County, the county's Public Safety Communications Department (radio system license holder) must approve the BDA installation on their network. Ensure all frequencies and settings are as authorized. Coordinate any needed frequency programming or unique identification of the BDA with their team. They may require an inspection of the installation or an isolation test witness (as noted). Maintain open communication to address any interference concerns – for example, if post-installation the radio network team detects noise from the building, be prepared to mitigate it (by adding filters or adjusting gain).
3. Wireless Carrier Coordination: If the DAS includes carrier frequencies for improved cell phone coverage, work with the carriers or a neutral host provider to integrate the system. This may involve submitting design plans to carrier RF engineering teams for approval. Adhere to any commissioning procedures the carriers have – for example, some carriers require a post-install optimization or verification of signal levels on their bands. If a neutral-host DAS approach is used (where a third-party manages the carrier signals), ensure that entity has provided all necessary agreements. Ultimately, the system should be transparent to the carriers' networks (non-disruptive) and ideally improve service; obtaining carrier acknowledgement helps protect the owner from any future claims of interference. Ensure to document any such coordination in the project close-out.
4. FCC Compliance: Ensure that operation of the BDA/DAS complies with FCC rules at all times. This includes not only using FCC-certified equipment but also adhering to the rule that no harmful interference is caused to any licensed wireless services. In case of an interference event (e.g., the FCC or carrier notifies of interference traced to the BDA), be ready to shut down the affected system and correct the issue. The School District shall be made aware of this responsibility. Post a copy of the FCC Station Class license or booster registration (if applicable) at the BDA location and include it in the documentation binder.

END OF SECTION

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SECTION 27 32 23 - ELEVATOR PHONES

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. Wiring and Communication devices in elevator cabs as required by regulatory agencies having jurisdiction.

1.2 REFERENCES

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2011 Edition.

B. See Section 01 42 00 – References for additional reference standards, definitions, acronyms, and abbreviations.

PART 2 – EXECUTION

2.1 INSTALLATION

A. Cable shall be installed in conduit in elevator machine room. Conduit nor cabling shall be exposed. Conduit shall be installed by electrical contractor and run within walls to recessed outlet box mounted in wall as indicated and located less than 12” (304 mm) from elevator equipment. Coordinate pathway installation with elevator contractor.

B. Leave 20 ft (6.09 m) coil of cable at end of pathway to be terminated by elevator contractor.

C. Label cable where it enters room in accord with Section 27 05 53 – Identification for Communications Systems.

D. Cable installer shall terminate cable with single voice module for testing purposes. Module will likely be removed by elevator contractor. No faceplate or box is required at this location.

END OF SECTION

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SECTION 27 41 00 - AUDIO-VISUAL EQUIPMENT

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. Provide installation, labor, services, and materials including cabling, connections, accessories, and associated testing and commissioning of audio-visual equipment for fully operational/turnkey, integrated system.

B. Audio-visual equipment includes interactive flat panel interactive and wall mounted screens, ceiling mounted projectors, flat screen TV's, document cameras, and sound distribution amplifiers.

C. Equipment locations are as indicated on floor plans, elevations, and equipment schedules.

1.2 RELATED SECTIONS

A. Section 01 22 00 – Unit Prices.

B. Section 01 25 13 – Product Substitution Procedures.

C. Section 01 31 00 – Project Coordination.

D. Section 01 33 00 – Submittal Procedures.

E. Section 01 42 00 – References.

F. Section 01 45 00 – Quality Control.

G. Section 01 78 00 – Clos out Submittals.

H. Section 01 91 00 – Commissioning.

I. Section 10 11 00 – Visual Display Surfaces.

J. Section 27 05 00 – Common Work Results for Communications Systems.

K. Section 27 05 26 – Grounding and Bonding for Communications Systems.

L. Section 27 05 28 – Pathways for Communications Systems.

M. Section 27 15 00 – Communications Horizontal Cabling.

N. Section 27 15 43 – Communications Faceplates and Connectors.

O. Section 27 16 00 – Communications Connecting Cords and Devices.

P. Section 27 18 00 – Communications Testing.

Q. Section 27 70 00 – Audio Enhancement System.

1.3 REFERENCES

A. See Section 01 42 00 – References for additional reference standards, definitions, abbreviations, and acronyms.

1.4 QUALITY ASSURANCE

A. Comply with Section 01 45 00 – Quality Control for project requirements.

B. Installer Qualifications:

1. Installer shall maintain local service department within a 120-mile radius of project, stock sufficient replacement parts to support specified warranty service and experienced and specialized in performing work specified.

2. Installer shall document capability of providing 24-hour service for emergency calls, and after-hours service with email and telephone numbers being used for such service.

C. Manufacturers Qualifications:

1. Equipment, components, and accessories specified shall be manufactured by company with minimum of three (3) years of documented experience.

1.5 SUBMITTALS

A. Comply with Section 01 33 00 – Submittal Procedures.

B. Product Data:

1. Provide listing of components, materials and services required for complete and fully operational system.
2. List manufacturer, model, and serial number (by room location), quantity provided, and short description of each item. Include manufacturer's catalog cuts.
3. Provide product specifications for each component and detail drawings for overall system/subsystem design.
4. Indicate product features and performance data and clearly indicate deviations, if any, from design criteria, accompanied by explanation of associated losses in system capability. Information shall indicate description of signal limitations.
5. Provide verification of Dealerships, products represented, personnel training Certificates, State of Florida, and local Licensing certificates.
6. Provide details regarding Conditions or Exceptions, if any, for installer to successfully complete contract within design criteria and price quotation.

C. Submit Shop Drawings listing each product and indicating product locations, and installation details.

1.6 COMMISSIONING

A. Comply with Section 01 91 00 – Commissioning requirements.

B. Test each piece of equipment for proper operation by manufacturer's approved technician prior to project substantial completion.

1.7 CLOSEOUT SUBMITTALS

A. Provide Project Record Drawings in accord with Section 01 78 00 – Closeout Submittals.

B. Provide 3 year's material and labor warranty for equipment and installation.

PART 2 – MATERIALS

2.1 APPROVED MANUFACTURERS

A. Only products of manufactures listed are approved. Other manufacturers requesting product approval shall comply with Section 01 25 13 – Substitution Procedures.

B. Whiteboards are specified in Section 10 11 00 – Visual Display Boards.

2.2 WALL MOUNTED INTERACTIVE FLAT PANEL SCREENS

A. Contact District (Owner) staff for current approved models.

2.3 WALL MOUNTED VIDEO SCREENS

A. TVs for Principals' Offices, Large Conference Rms, and other Assembly Spaces where indicated.

B. Contact District (Owner) staff for current approved models.

2.4 CEILING PROJECTOR

A. For Assembly Spaces, Auditorium, Gymnasium, Media Center, Multipurpose and Lab Areas where indicated.

B. Contact District (Owner) staff for current approved models.

2.5 DOCUMENT CAMERA

A. Contact District (Owner) staff for current approved models.

2.6 WIRE, CABLE, CONNECTIONS, AND ACCESSORIES

A. Installer shall furnish and install appropriate cables in accord with Division 26-Electrical and Division 27-Communications Sections.

PART 3 – EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

A. Delivery, Storage and Handling:

1. Deliver equipment in manufacturers unopened boxes and store in secure area until installation.
2. Unbox equipment and remove all boxes and associated trash from site.
3. Store and handle equipment in accord with manufacturer’s instructions.

3.2 INSTALLATION

A. Securely mount equipment plumb and square in place. Where equipment is installed in cabinets, provide mounting bolts in equipment fastening holes. Mounting bolts are to be provided with nylon washers between bolt heads and equipment.

B. Install electronic equipment in appropriate equipment cabinets and/or racks.

C. Install equipment ensuring appropriate ventilation to meet manufacturer’s requirements.

D. Confirm polarity and phasing of system components before installation. Connect to maintain uniform polarity and phasing.

E. Wiring shall be free from ground loops, shorts, opens and reversals.

F. Provide 12” service loop at each outlet. Leave service loops at equipment cabinets to allow operation of equipment outside cabinets and allow full access to rear of cabinets and installed equipment.

G. Neatly tie electronic cables within equipment cabinets, housings, and terminal cabinets with Velcro fasteners at not more than 12” intervals. Install in accord with current EIA installation standards. Use FLEXO-WRAP Heavy Wall (HW 1½” black) to bundle cables behind IFP or TV

H. Provide individually labeled System cables at each end with typed or pre-printed cable marker labels. Handwritten labels are not permitted.

I. Install with security-type fasteners for all open area equipment.

J. Provide necessary installation hardware, cabling connectors and wall plates with connector interface.

3.3 EQUIPMENT COORDINATION

A. Projector locations shall be coordinated with reflected ceiling grid, and wall mounted accessories to avoid conflict with HVAC diffusers, speakers, fire sprinklers and light fixtures, and clocks.

B. Projectors shall be centered on the projection screen in each room where indicated, mounted from the ceiling as indicated.

3.4 FIELD QUALITY CONTROL

A. Field Testing:

1. Measure and adjust for optimum signal quality and minimum signal loss for all audio and video.

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B. Projector lenses shall be installed after installer determines most appropriate lens for projector location and use.

3.5 TESTING AND DEMONSTRATION

A. Equipment shall be tested no later one week after substantial completion.

B. Upon completion of system installation notify Owner's Project Manager that system is ready for testing and demonstration.

C. Conduct tests and demonstrations in presence of Owner's Project Manager.

D. Demonstrate system and equipment functions.

E. Test and demonstrate that equipment functions properly and is ready for Owner's training sessions.

F. Upon completion of equipment testing and demonstration, turn over equipment cabinet keys and non-installed equipment to Owner's Project Manager.

3.6 TRAINING

A. Provide two separates 2-hour blocks of training to district staff in operation of audio- visual equipment including projectors, document cameras, and sound distribution amplifier. Owner shall select date and time for each training session.

B. Provide operating and users guides to the Owner's Project Manager at first training session.

C. Training sessions shall be video recorded with master and two (2) copies turned over to Owner's Project Manager within 7 days of last training session.

END OF SECTION

SECTION 27 41 16 - AUDIO SYSTEMS AND EQUIPMENT FOR CLASSROOMS

PART 1 – GENERAL

1.1 SCOPE

A. This section describes the products and execution requirements related to furnishing and installing classroom AV and related subsystems.

1.2 RELATED WORK

A. Section 27 10 00, 27 15 00, 27 41 33, 27 51 13, and 28 23 00.

1.3 SUBMITTALS

A. Comply with Section 01 45 00 – Quality Control for project requirements.

B. Prior to Work: Submittals shall be provided to Owner and Consultant within ten (10) days after the notice to proceed.

C. Project Timeline: Project timeline will not be altered due to lateness of submittals. Contractor will remain bound to deliver a timely, complete, and finished project as stipulated in their contract.

D. Submit in digital form Detail Drawings, Product Data, Manufacturer's Recommendations, Operations and Maintenance, and applicable Manufacturer's Warranties for all materials proposed. Submittals shall be sent to the Owner and Consultant for review and approval.

1. Detail Drawings:
    a. Detail Drawings shall be from approved manufacturer and for each type of flat panel display.
    b. Detail Drawings shall contain plan view locations, elevations, installation details, and all accessories.
2. Product Data:
    a. Product data shall be from approved manufacturer and for each type of flat panel display to be installed.
    b. Product data shall contain manufacturer's technical data, product specifications, installation procedures, and other pertinent information as applicable for each product or material specified.
3. Manufacturer's Recommendations:
    a. Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, these manufacture recommendations shall be part of the submittal sets. Installation of the item will not be allowed to proceed until the recommendations are received and approved.
    b. Work shall not proceed without the approved submittals.
4. Operations and Maintenance information and instructions for each product.
5. All applicable Manufacturers' Warranties, standard and extended.

E. Submittals shall be received and reviewed by Owner and Consultant prior to the procurement of material or the commencement of work. Any procurement or work performed prior to this approval is at Contractor's own risk.

F. The failure of Contractor to provide submittals as required herein may result in the withholding of payment for work and/or the cancellation of the contract.

1.4 FINAL CLOSE-OUT DOCUMENTATION

A. Contractor shall provide written notification to Consultant and Owner when Contractor is satisfied that the work has been completed and is ready for inspection.

B. Contractor shall provide closeout submittals to Owner and Consultant in accordance with the requirements found in these documents. Owner and Consultant shall receive the closeout submittals no less than three (3) business days prior to the scheduled final inspection.

C. Contractor is required to be present for the final inspection by Owner and Consultant.

D. Work or materials found to be incomplete, of unsatisfactory quality, failing to meet the specifications in these documents, and/or unacceptable to Consultant or Owner shall be documented by Owner and Consultant and provided to Contractor to rectify.

E. If more than one (1) re-inspection is necessary, the costs of the additional travel, hours, and expenses of Owner and Consultant may be deducted by Owner from the contract amount due Contractor.

F. Once all punch list items are complete, the Contractor shall return an initialed punch list to the Consultant and Owner for verification. Punch list shall be considered complete only after having been signed by Owner and Consultant.

G. Upon completion of the installation, the Contractor shall provide three (3) full sets of documentation to the Owner and Consultant for approval.

H. Close out documents should include three (3) 3-ring binders with the following:

1. Any/all moves, adds, or changes between submittal process and project completion.
2. As-built drawings.
3. Product documentation including location, part numbers, serials and property identifiers if required.
4. Certificate of testing/completion completed by a RCDD.
5. Letter of completion
    a. Signed by an Authorized Agent
    b. Includes project description.
    c. Includes project completion date and warranty start/finish dates.

I. All documentation, including hard copy and electronic forms, shall become the property of the Owner.

1.5 SOLE SOURCE PROVIDERS

A. For each product required, obtain all materials from one source for a single, approved manufacturer.

1.6 CERTIFICATIONS AND LICENSING

A. Where materials or equipment are specified to conform, be constructed, or be tested to meet specific requirements, certification that the items provided conform to such requirements. Certification by a nationally recognized testing laboratory that a representative sample has been tested to meet the requirements, or a published catalog specification statement to the effect that the item meets the referenced standard, will be acceptable as evidence that the item conforms.

B. Installers:

1. The Contractor shall have an appropriately certified installer on staff assigned to manage this Project; documented proof shall accompany the proposal response.
2. All installing personnel shall have completed and be certified in manufacturer training or the Contractor shall contract with manufacturer for installation of all proposed components. Company Certifications shall accompany the proposal response.
3. The Contractor shall submit certification that installers are factory certified to install and test the provided products. No less than half of the crew to be used for the installation shall be trained by that manufacturer for the work.

C. Contractor must maintain a minimum of one BICSI RCDD on staff for the duration of the project.

D. Contract must currently and appropriately be licensed in the State, County, City of the project for the scope provided.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Vendor shall be responsible for all materials until completion of Project.

B. Products and materials shall be stored according to manufacturer's recommendations at minimum. In addition, products and materials shall be stored in a secure location, protected from vandalism, weather, moisture, and extremes in temperature.

C. Products and materials shall be stored upright inside in original packaging. Contractor shall insure that packaging is undamaged.

D. If the Contractor wishes to have a trailer on site for storage of materials, arrangements shall be made with the Owner. Any fees associated with onsite trailer are the responsibility of the contractor.

E. Contractor shall verify the acceptability of site conditions with the manufacturer prior to receiving any products and materials.

1.8 WARRANTY

A. The Contractor shall provide to the Owner a manufacturer's standard warranty certificate for all materials, equipment, etc. Upon successful completion of the installation and subsequent inspection, the Owner shall receive a numbered certificate. This warranty shall include all labor, materials, and travel time.

B. The warranty shall ensure against product defects.

C. The warranty shall cover the replacement or repair of defective product(s) and labor for the replacement or repair of such defective products(s) at no cost to the Owner.

D. The minimum warranty period shall be one year from certificate of completion or owner acceptance, whichever is later in date.

E. The Contract shall provide information on available extended warranties.

PART 2 – PRODUCTS

2.1 Contact District (Owner) staff for current approved models of all equipment.

A. Classrooms will be equipped with interactive flat panel (IFP) displays and AV Cabling.

B. Classrooms will be outfitted with an audio reinforcement system including microphone and integrated digital paging system.

C. All cablings must be manufacture approved/provided and rated for installation in space.

1. Owner-supplied teacher's PCs and other video sources shall connect to the Classroom IFP through a wall input plate with location shown on drawing. This input plate shall have two Cat 6 cables installed in a point-to-point fashion between the teacher station and flat panel with same specifications for structured cabling, going from the teacher station wall plate to the IFP location wall plate.

2. The amplified audio signal shall be distributed in the classroom as defined in the owner supplied spec. The speakers shall field coordinate with the consultant, general contractor and other trades, final location to provide the best coverage of the classroom student seating area.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper and timely completion before work is to start.

B. Examine room conditions and wall surfaces to assure they are in compliance with manufacturer's requirements.

C. Where necessary, field-verify measurements before ordering units.

D. Do not proceed until unsatisfactory conditions have been corrected and signed off by the owner or consultant.

3.2 INSTALLATION REQUIREMENTS

A. Contractor shall furnish and install all interactive flat panels and associated products and materials as shown on Drawings and as specified above.

B. It is the Contractor's responsibility to survey the site and or engineered drawings and specifications and include all necessary costs to perform the installation as specified.

C. Beginning installation means Contractor accepts existing conditions.

D. Contractor shall furnish all required installation tools and hardware to facilitate complete installation.

E. Install interactive flat panel units in locations and at mounting heights indicated, according to manufacturer's written instructions and customers standards as well as to National and local codes and ordinances.

F. All cablings shall be supported and labeled properly using approved hangers and hooks. Cabling installed in spaced defined as a plenum will be rated for installation in those spaces.

G. The Contractor shall be responsible for identifying and reporting to the Owner and Consultant any existing damage to walls, flooring, tiles, and furnishings in the work area prior to start of work. All damage to interior spaces caused by the installation of interactive flat panels and related materials shall be repaired by the Contractor.

H. Repairs shall match preexisting color and finish of walls, floors, and ceilings. Any Contractor-damaged ceiling tiles, floor, and carpet shall be replaced to match color, size, style, and texture.

I. Where unacceptable conditions are found, the Contractor shall bring this to the attention of the construction supervisor immediately. A written resolution will follow to determine the appropriate action to be taken.

J. Qualified personnel utilizing state-of-the-art equipment and techniques shall complete all installation work.

K. Avoid abrasion and other damage to materials during installation.

L. The interactive flat panel system will be tested and documented upon completion of the installation as defined in the section below.

M. Any changes to scope, location, installation, or anything that would impact the functionality and performance of the designed system must be submitted to the General Contractor and consultant via a written RFI. The contractor, consultant and owner will respond with an approval or change in design.

3.3 TESTING AND ACCEPTANCE

A. The Contractor shall perform acceptance tests as indicated below for each classroom AV system.

B. The Contractor shall supply all equipment and personnel necessary to conduct the acceptance tests. Prior to testing, the Contractor shall provide a summary of the proposed test plan. The Owner and Consultant will approve the method of testing.

C. The Contractor shall visually inspect all products and materials to ensure that they are complete and conform to Detail Drawings and specifications defined herein. The Contractor shall provide the Owner and Consultant with a written certification that this inspection has been made.

D. The Contractor shall conduct acceptance testing according to a schedule coordinated with the Owner and Consultant. Representatives of the Owner may be in attendance to witness the test

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procedures. The Contractor shall provide a minimum of one (1) week advance notice to the Consultant and Owner to allow for such participation.

E. The contractors RCDD must verify all testing and note in the close out documentation that all testing was performed as required and all systems are functioning within manufactures specifications and have been installed per the engineered design.

3.4 ADJUSTING

A. Verify that accessories required for each unit have been properly installed and working as intended.

3.5 CLEANING

A. Remove all debris, trash, and waste materials from site.

B. Clean units according to manufacturer’s written instructions.

3.6 DOCUMENTATION

A. All serial numbers, IP addresses, MAC address and Model number must be captured per room per device and delivered to owner in print and digital form.

B. All user manuals must be submitted to owner.

3.7 TRAINING

A. Contractor must provide end user training on the use of all equipment and software included in the install.

B. Training material and manuals must be included.

C. Administrative Training must be held for technical staff in the care, maintenance, administration and troubleshooting of the systems installed.

END OF SECTION

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SECTION 27 41 33 - LOCAL AREA SOUND SYSTEM - CAFÉ/CAFETORIUM, LARGE VENUE SPACES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 1, General Requirements, are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Each large venue space will need a dedicated audio and video design for the space that it is supplying. The following specifications can be used as guidelines for the design.

B. This Section includes the following:

1. The work required under this section shall include all labor, materials, equipment, and services necessary for and reasonably incidental to, the furnishing and installation of completely coordinated audio/video system. The system shall be of the distributed type.
2. All microphones, microphone stands, wire and accessory items to provide a complete and functional system.
3. Systems shall be completely operable and comply with design objectives. Where a functional specification is listed or where more than one manufacturer is listed, the option to use such equipment provided that all aspects of the specification are met. Where two or more units of the same class of equipment are required, only a single manufacturer is to be used, but individual classes of equipment may be the products of different manufacturers. All equipment must be compatible.
4. Additional equipment accessories or incidentals required to fulfill the intent of these specifications, whether specifically mentioned herein, shall be provided without claim for additional payment, being understood that a complete operational system is required.
5. All cable shall be installed in conduit unless otherwise noted.

1.3 PROJECT SITE VISITATION

A. Review installation requirements prior to permanently installing equipment and/or making mechanical or electrical connections.

B. Coordinate meeting and requirements to ensure presence of parties concerned.

1.4 SUBMITTALS

A. The full audio and video system design shall be submitted to the architect and owner for approval, and following Section 01 45 00 – Quality Control for project requirements.

B. Product Data: Include the following:

1. Power amplifiers.
2. Digital Signal Processor.
3. Microphone and stand.
4. Wireless microphone.
5. Paging adapter.
6. Equipment cabinet and rack.
7. CD Player
8. Loudspeakers.
9. Microphone and Microphone/Monitor outlets.

10. Custom Multi-Circuit Cables (Snakes).
11. Mixing console.

1.5 SHOP DRAWINGS:

A. Equipment Details: Detail equipment assemblies and indicate dimensions, weights, required clearances, method of field assembly, components, and location of each field connection.

B. Included with the Shop Drawings for this Specification Section shall be EASE documentation verifying the proper loudspeaker placement and aiming as prepared by the successful contractor. EASE documents for Direct and Total Coverage at 4 kHz, 2.5 kHz and 250 Hz shall be provided to show proof of performance. In addition, ALCONS (Intelligibility) Plots shall be provided at 2 kHz.

C. Wiring Diagrams: Power, signal, and control wiring. Include the following:

1. Identify terminals to facilitate installation, operation, and maintenance.
2. Single-line diagram showing interconnection of components.
3. Cabling diagram showing cable routing.

D. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

E. Qualification Data: For Installer.

F. Field quality-control test reports.

G. Operation and Maintenance Data: For public address and music equipment to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Source Limitations: The work of this section has to be performed by a contractor actively engaged in the installation and service of these systems for at least 10 years. Proof of such activities including list of installations completed within the last three years shall be furnished with submittal drawings. The contractor shall show satisfactory evidence, upon request, that they maintain a fully equipped service organization capable of furnishing adequate inspection and service to the system, including replacement parts. The contractor shall be prepared to offer a service contract for the maintenance of the system after the guarantee period.

B. The installer shall present proof substantiating their affiliation as an authorized dealer for the products being submitted. The authorized contractor shall produce evidence that they have a fully experienced and established service organization for at least five years and proven satisfactory installations during that time. The authorized contractor shall provide warranty and service work within 4 hours of notification of such requirements.

C. While alternate manufacturers are presented for each device, alternate products submitted to shall be of equal or greater performance to be considered for use on the project. When an alternate device is chosen, the contractor shall complete a “Request for Substitution” form and submit per Division 01.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Comply with the following codes and standards:

1. NFPA 70 (National Electrical Code)
2. Electronics Industries Association – 160 for Sound Systems
3. Electronics Industries Association – 299A for Speakers

4. Electronics Industries Association – 310C for Racks, Panels, and associated equipment.
5. Underwriters Laboratories – 50 for Enclosures.

1.7 TESTING

A. Provide complete testing equipment recommended by the equipment manufacturer and conduct factory approved load testing and any testing hereinafter specified. Submit three copies of all test procedures and test results for the following:

1. Provide Impedance readings on the Speaker Circuits after installation is complete. Log this data on the “As Build” Drawings.
2. Verify any Input or Output cable is free from grounds prior to system initialization and provide a written log of this test.
3. Perform real time analysis of the main loudspeakers after balancing and equalization of the system is complete. Provide a color graph showing the results from the acoustic coverage test for 20 Hz to 20 k Hz at five (5) locations in the Multipurpose Room.
4. Provide printed record of final Digital Signal Processor configuration. In addition, provide a digital record of this configuration along with the manufacturer’s installation software for the associated Digital Signal Processor configuration software.

1.8 TRAINING SERVICE

A. Provide minimum of eight hours of classroom instructions for system, not necessarily consecutive time periods. Schedule times with Owner's authorized representative.

1.9 PROJECT CONDITIONS

A. Provide products that are suitable for the environment which they are intended to be installed. Comply with all manufacturer's ambient temperature adjustment factors and installation requirements.

1.10 COORDINATION

A. Coordinate installation of all equipment, devices, conduit, wiring, supports, etc. with all project conditions.

PART 2 – PRODUCTS

2.1 PERFORMANCE MIXING CONSOLE

A. Number of mic/line inputs: 16 channels (balanced XLR and ¼” phone jacks)
B. Number of outputs: 3 main (LRM) and 6 Aux Sends
C. Frequency Response: 20 to 50,000 Hz
D. THD: <.003%
E. Phantom power: + 48 VDC
F. Channel Equalizer: 4 Band, 2 Sweep EQ
G. Faders: 100 mm
H. Balanced Outputs: Main Outputs and first four Aux sends equipped with true balance option.

2.2 GENERAL USE MIXER

A. Number of mic/line inputs: 6 Balanced ¼” and XLR
B. Number of outputs: 3 main (LRM) and Aux
C. Frequency Response: 20 Hz to 20 k Hz
D. THD: < .05% @ +4 dBu
E. Phantom Power: +48 VDC

F. Channel Equalizer: 2 Band on each Input

G. Balance Outputs: Pseudo Balanced on L, R and Transformer Balanced on Mono Output

2.3 DIGITAL SIGNAL PROCESSOR

A. Number of Inputs: 3 channels

B. Number of Outputs: 6 Channels

C. Frequency Response: 20 to 20, 000 Hz +/- .1 dB

D. Connectors: XLR

E. Maximum Input Level: + 20 dBu

F. Input Impedance: 10 k Ohms

G. Digital Sampling: 40-bit 96 kHz

H. Dynamic Range: >115 dB (unweighted 20 Hz to 20 kHz)

I. Output Impedance: 50 ohms

J. Maximum Output Level: +20 dBu

K. Connector DB9F and 10/100 Ethernet Port

2.4 POWER AMPLIFIERS

A. Features: Dual Channel Amplifier, front panel level controls, advanced clip eliminator and adjustable speed cooling fans

B. Frequency Response: 20 to 20,000 Hz (+/- 1 dB)

C. THD: .02 % at rated frequency response

D. Controls: Front Level Adjustment, Low Frequency Filter, Stereo/Bridge control

2.5 LOUDSPEAKERS MAIN

A. Speaker Size and Type: One 15” Permanent Magnet Cone-type Low Frequency Driver treated with Ferrofluid and One 3” Voice Coil with 2” Exit Horn-loaded Compression Driver treated with Ferrofluid with a 90 Degree X 40 Degree Dispersion.

B. Power Rating: 400 Watts Continuous/1600 Watts Peak

C. Frequency Response: 46Hz – 20 kHz (+/-3dB)

D. Speaker Impedance: 8 ohms

E. Sensitivity: 98 dB at 1 meter with 1-watt input

F. Mounts: Manufactures recommended Yoke Mounting Accessory

2.6 DELAY LOUDSPEAKERs (as needed)

A. Speaker Size and Type: One 8” Permanent Magnet Cone-Type Low Frequency Driver treated with a Waterproofing Compound, one 6.5” Permanent Magnet Cone- Type Mid Frequency Driver treated with a Waterproofing Compound and one 1.5” Voice Coil, 1” exit horn-loaded compression driver treated with Ferrofluid.

B. Power Rating: 225 Watts Continuous/900 Watts Peak

C. Frequency Response: 62 Hz – 20kHz (+/- 3dB)

D. Speaker Impedance: 8 ohms

E. Sensitivity: 94 dB at 1 meter at 1-watt input

2.7 PORTABLE MONITOR LOUDSPEAKERS

A. Speaker size and type: One 15: Differential Drive low frequency driver and one 1” Throat Diameter compression driver.

B. Power Rating: 450 Watts/900 Peak

C. Frequency Response: 42 Hz – 18 kHz (+/- 3 dB)

D. Inputs: Line Level and Microphone Input Compatibility

2.8 HANDHELD WIRELESS MICROPHONE TRANSMITTER SUPER-CARDIOID AND RACK MOUNTABLE RECEIVER (QTY 3)

A. Frequency Response: 50 to 15,000 Hz +/- 2 dB.

B. RF Sensitivity: <2.5µV -105 dBm for 12 dB SINAD, typical.

C. Switchable Frequencies: 960.

D. Frequency Range: 470-494, 494-518, 518-542, 472-596, 638-662, 702-726, 794-

E. 806, 800-820, 838-865, 806-810 and 740-752 MHz.

F. Antenna Impedance: 50 ohms.

G. Image Rejection: >70dB.

H. THD: .5% Typical.

I. Microphone: Cardioid Dynamic Handheld Microphone

2.9 WIRELESS MICROPHONE RACK MOUNTABLE RECEIVER ANTENNA SPLITTER AND REMOTE ANTENNA (QTY 1 ANTENNA SPLITTERS WITH 2 ANTENNA)

A. Antenna Distribution as manufactured by the Wireless Microphone system manufacturer with approved compatibility.

2.10 WALL MICROPHONE OUTLETS / CUSTOM MULTI-CIRCUIT CABLES (SNAKES) / MONITOR PLATES

A. Microphone/Monitor Plates:

1. Quantity: Locations as shown on the project drawings
2. Connection: Neutrik D Series Black Female Connector for Microphone Connections
3. Connector: Locking Neutrik ¼” TRS on Monitor Connections
4. Material: Anodized Aluminum (Black or Clear as chosen by owner)
5. Labeling: Engraved labeling

B. Booth Mounted Mixer Custom Multi-Circuit Cables with Matching Interface Plate:

1. Quantity: Number of Inputs and Devices as shown on the drawings
2. Length: Length of each snake as shown on the drawings or 50 Feet Minimum
3. Labeling on Plate: Engraved or Silk Screened
4. Labeling on Snake: Shrink Labeled to match input plate location and numerical sequence for output connections.
5. Connectors: Neutrik N Series Nickel Male Connector for Microphone Connections and Amphenol M Series for TRS connections.

2.11 ASSISTIVE LISTENING SYSTEM

A. Provide assistive listening device as required with 30 dB gain, 58 dB S/N, 120-volt ac, 60 Hz electrical input with switchable audio input microphone, line and 70 v line with attenuator, single transmitting channel selected from any one of sixteen frequencies. Provide Remote Antennas

and Extension Cables for locations as shown on the drawings or as required to cover the space and manufacturers recommended surge protection.

B. Provide quantity of receivers with volume control, on/off switch, external jack for audio out and charger, receiving frequency to match transmitting frequency to meet ADA requirements. <2% distortion. S/N >60dB.

C. Provide with rechargeable NiCad batteries. Provide neck loop assemblies for the quantity of Hearing Aid compatible indicated and earbuds for the remaining quantities or receivers as indicated in the chart below and as based upon the occupancy of the space.

Capacity of Seating in Assembly Area	Minimum Number of Required Receivers	Minimum Number of Required Receivers Required to be Hearing-aid Compatible
50 or less	2	2
51 to 200	2, plus 1 per 25 seats over 50 seats[1]	2
201 to 500	2, plus 1 per 25 seats over 50 seats[1]	1 per 4 receivers*
501 to 1000	20, plus 1 per 33 seats over 500 seats[1]	1 per 4 receivers*
1001 to 2000	35, plus 1 per 50 seats over 1000 seats[1]	1 per 4 receivers*
2001 and over	55 plus 1 per 100 seats over 2000 seats[1]	1 per 4 receivers*

*or fraction thereof

D. Provide quantity of battery chargers to support at least 50% of the receivers at a given time.

2.12 CD PLAYER

A. Frequency Response: 20 to 20 K Hz

B. S/N Ration: 107 dB

C. Channel Separation 90 dB

D. Compatibility: CD-R/RW Playback Compatibility

E. Outputs: Headphone, Coaxial RCA and Analog

F. Pitch Control: +/- 12%

G. Playback: MP3

2.13 SCHOOL INTERCOM INTERFACE

A. Interface to receive signal from the 25 Volt Intercom systems and trigger a relay to mute the sound system.

2.14 EQUIPMENT HOUSINGS

A. Equipment rack:
   1. Construction: 16 ga. Welded frame
   2. Mounting Rails: 11 ga. CRS adjustable
   3. Size: 24 RU 23 ½" in. usable depth
   4. Included accessories: vent panels, Bland Panels and Front Door

B. Rack accessories:

C. Sequential Power Control

D. Timing Sections: Six (6)

E. Intervals: 1, 3 or 6 second

F. Indicators: Front Panel Digital AC Mains Voltage and Current Meter

G. Power Control Modules (Quantity 3)
   1. Power Rating: 20 Amp Power Conditioner and Spike Suppressor for all Equipment accept Digital Signal Processor and amplifier supporting Rear Delayed Loudspeakers.
   2. Power Rating: 15 Amp Power Conditioner and Spike Suppressor for Digital Signal Processor
   3. Wire Fire Alarm Form C Relay and Intercom Relay to disable during Alarm or Intercom Event
   4. Power Rating: 15 Amp Power Conditioner and Spike Suppressor with Key Switch for disabling the amplifier supporting the Rear Delayed Loudspeakers when not required.
   5. Quantity: As required by current draw of equipment in cabinet.

2.15 SYSTEM ACCESSORIES

A. The following system accessories shall be provided new and in unopened cartons to the Owner:
   1. Dynamic hand-held CARDIOID microphones with stand adapter.
   2. Telescoping microphone stands.
   3. Twenty-five-foot microphone cables, male connector one end, female connector opposite end.
   4. Fifty-foot microphone cables, male connector one end, female connector opposite end.
   5. Dual ear covering, sealed, supra-aural, stereo.

2.16 SYSTEM WIRING

A. Microphone/Input circuits – shielded – twisted pair 22 (7x30) .135" OD 200 Volts West Penn No. 452.

B. Speaker circuits 8 ohm – 2 conductor – twisted pair 12 (19x25) .269" OD 300 Volts West Penn No. 227.

PART 3 – EXECUTION

3.1 **INSTALLATION**

A. Wiring Method: Install wiring in raceways. Make final connections to the amplifier with non-metallic fitting to isolate any building noise from the amplifier. Transition to non- metallic conduit for the last 6" if non-metallic fitting is not available.

B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess. Use manufactures recommended harnesses in cabinets.

C. Control-Circuit Wiring: Install number and size of conductors as recommended by system manufacturer for control functions indicated.

D. Separation of Wires: Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate raceways or, where exposed or in same enclosure, separate conductors at least 12 inches (300 mm) for speaker microphones and adjacent parallel power and telephone wiring. Separate other intercommunication equipment conductors as recommended by equipment manufacturer.

E. Splices, Taps, and Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

F. Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.

G. Identification of Conductors and Cables: Color-code conductors and apply wire and cable marking tape to designate wires and cables so they identify media in coordination with system wiring diagrams.

H. Wall-Mounting Outlets: Flush mounted.

I. Conductor Sizing: Unless otherwise indicated, size speaker circuit conductors from racks to loudspeaker outlets not smaller than No. 12 AWG and conductors from microphone receptacles to amplifiers not smaller than No. 22 AWG.

J. Weatherproof Equipment: For units that are mounted outdoors, in damp locations, or where exposed to weather, install consistent with requirements of weatherproof rating.

K. Speaker-Line Matching Transformer Connections: Make initial connections using tap settings indicated on Drawings.

L. Connect wiring according to Section Building Wire and Cable.

3.2 GROUNDING

A. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

B. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.

C. Install grounding electrodes as specified in Section Grounding and Bonding.

3.3 IDENTIFICATION

A. Install permanent typed labels on all cables and wiring to identify input, output, zone, and speaker numbers.

3.4 FIELD QUALITY CONTROL

A. Manufacturer’s Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Retain one of three paragraphs below.

C. Perform the following field tests and inspections and prepare test reports:

1. Schedule tests with at least seven days' advance notice of test performance.
2. After installing public address and music equipment and after electrical circuitry has been energized, test for compliance with requirements.
3. Operational Test: Perform tests that include originating program and page messages at microphone outlets, preamplifier program inputs, and other inputs. Verify proper routing and volume levels and that system is free of noise and distortion.

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4. Acoustic Coverage Test: Feed pink noise into system using octaves centered at 500 and 4000 Hz. Use sound-level meter with octave-band filters to measure level at five locations in each zone. For spaces with seated audiences, maximum permissible variation in level is plus or minus 2 dB. In addition, the levels between locations in the same zone and between locations in adjacent zones must not vary more than plus or minus 3 dB.
5. Power Output Test: Measure electrical power output of each power amplifier at normal gain settings of 1,000 Hz.
6. Signal Ground Test: Measure and report ground resistance at public address equipment signal ground. Comply with testing requirements specified in Section Grounding and Bonding.
7. Retesting: Correct deficiencies, revising tap settings of speaker-line matching transformers where necessary to optimize volume and uniformity of sound levels, and retest. Prepare a written record of tests.
8. Inspection: Verify that units and controls are properly labeled, and interconnecting wires and terminals are identified. Prepare a list of final tap settings of paging speaker-line matching transformers.
9. The system shall be guaranteed for a period of one year from date of final acceptance.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements.

C. Complete installation and startup check according to manufacturer's written instructions.

3.6 ADJUSTING

A. On-Site Assistance: Engage a factory-authorized service representative to provide on- site assistance in adjusting sound levels, resetting transformer taps, and adjusting controls to meet occupancy conditions.

B. Occupancy Adjustments: When requested within 12 months of date of Final Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose, without additional cost.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain public address and music equipment. See paragraph 1.7.A above.

B. The Owner shall be furnished with four (4) brochures that provide written operating instructions for the system, wiring diagrams and maintenance notes.

END OF SECTION

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SECTION 27 51 16 - INTERCOM SYSTEM

PART 1 – GENERAL

1.1 DESCRIPTION

A. A comprehensive sound and communications system shall be provided as specified and as shown on the plans.

B. System shall be Audio Enhancement EPIC System.

C. The system shall consist of the following: A sound and communications center (console; administrative telephones or comparable; classroom speakers; other remote speakers; call-in switches) and all associated material, hardware and wiring necessary for a completely installed and operating system that meets the specified requirements.

D. Surge Suppression:

1. The contractor shall have equipment installed on the 70v lines taking care to arrest damaging electrical transient and spikes which can cause damage to the components of the system.
2. See Section Surge Suppression Equipment.

E. In-service Training: Provide the owner with a training program designed to make all administrative control station users familiar with the operation of the voice communication system. The contractor shall instruct four (4) personnel designated by the owner in the proper use, basic care, and maintenance of the equipment. Such training shall be provided as an integral component of the system.

F. Provide terminal cabinets sized to house terminal strips and surge equipment.

G. System shall include authenticated SIP endpoint tie-in capability for connection to Owner’s existing phone system.

1.2 STANDARDS, CODES, REFERENCES, AND REGULATORY REQUIREMENTS

A. Provide and install the intercom systems in accordance with the National Electrical Code, and the Florida Administration Code, Chapter 6A-2, latest edition, and the following:

1. Reference Division 01 requirements.
2. All applicable requirements of EIA/TIA.
3. All applicable requirements of Federal Communications Commission.
4. National Fire Protection Association Standards:
   a. NFPA 72 National Fire Alarm Code
   b. NFPA 101 Code for Safety to Life from Fire in Buildings and Structures
5. UL 13 - Power-Limited Circuit Cables
6. UL 444 - Communications Cables
7. UL 497 - Protectors for Paired Conductor Communication Circuits
8. UL 497A - Secondary Protectors for Communication Circuits
9. UL 497B - Protectors for Data Communication and Fire Alarm Circuits
10. UL 813 - Commercial Audio Equipment
11. UL 910 - Test for Flame-Propagation and Smoke-Density Values for Electrical and Optical-Fiber Cables Used in Spaces Transporting Environmental Air
12. UL 1449 – 3rd Edition Standard for Safety for Surge Protective Devices
13. UL 1581 - Reference Standard for Electrical Wires, Cables, and Flexible Cords

14. UL 1666 - Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts
15. UL 1685 - Vertical-Tray Fire Propagation and Smoke Release Test for Electrical and Optical-Fiber Cables
16. UL 1778 - Uninterruptible Power Supply Equipment
17. Florida Building Code
18. Florida Fire Prevention Code

1.3 SUBMITTALS

A. Submit shop drawings in accordance with Section Submittals, and the following:

1. Submit manufacturer's data on all products, including but not limited to catalog cut sheets, roughing-in diagrams, installation instructions, operation and maintenance manuals, typical wiring diagrams and risers, equipment rack elevations.
2. Submit installation/layout shop drawings on the intercom systems, showing the interrelationship and position of all components.
3. Submit a components identification schedule indicating numbers and/or colors of the identification system and the corresponding component, conduit, or wire.
4. Submit a detailed step-by-step testing procedure for a component-by-component system functional checkout and test.
5. Submit point-to-point wiring diagrams and block diagrams of system to be **installed.**

1.4 EQUIPMENT WARRANTY

A. The contractor shall warrant the equipment to be new and free from defects in material and workmanship, and will, within one year from date of final completion, repair or replace any equipment found to be defective.

1. No charges shall be made by the installer for any labor, equipment, or transportation during this period to maintain functions.
2. Respond to trouble call within twenty-four (24) hours after receipt of such a call.

1.5 SYSTEM OPERATION

A. The system shall provide, as a minimum, the following functions.

1. Emergency Announcements - at a preset volume level, to all system speakers, initiated by an administrative console or phone. The emergency operation shall bypass all other control functions and shall override all other programs.
2. All-Call Capability - transmission of a program to all classrooms and other speaker locations by the operation the administrative console or phone.
3. Intercom capability:
    a. Provide 2-way voice communication directly between the administrative console and any speaker location (classroom, office, etc.).
    b. Adequate power (10-watts minimum) to override high noise level areas, such as bus loading points, etc., permitting practical 2-way voice communications.
    c. Provide for call-in from any suitably equipped speaker station. Call origination shall require only the momentary depression of the call origination switch, which will sound a tone at the administrative console and indicate the room number and call level associated with the calling classroom.
    d. Supervisory Tone - facilities for automatically sounding a supervisory, warning tone signal (beep) over any speaker selected by the administrative telephone to alert

personnel in the room to the call and to prevent unauthorized monitoring (eavesdropping). The warning tone shall repeat at regular intervals.

e. Privacy - facilities to positively prevent the control center from monitoring any classroom which has the call-in switch in the "privacy" position, while still allowing the control center to call and to talk to the classroom.

4. Program Capability:
   a. Separate inputs and preset volume controls for up to three (3) microphone or auxiliary inputs.
   b. Distribution of voice announcements from an external microphone to any or all speakers.
   c. Selective distribution of program material to at least five (5) classrooms or other speaker locations.
   d. Preset microphone level, emergency level, and bass and treble tone controls (boost and cut).
5. Exterior speakers:
   a. Provide weatherproof speakers around the outside of the building where shown on plans.
6. System amplifiers shall be capable of providing sufficient volume for emergency paging of all speakers with a 20 percent spare reserved capacity for future expansion.
7. System must interface with owner phone system that will allow all-call functionality.
8. All programable options must be accessible from a web interface on the Owner’s production network.
9. Include Master Clock and/or Digital Signage options/package in submittal and design.

1.6 EQUIPMENT

A. Provide a complete and operating system with accessories as required, including but not limited to conduit, wire, equipment, surge suppression and terminal cabinets with plywood and terminal strips.

PART 2 – PRODUCTS

2.1 SPEAKERS – INTERIOR

A. Interior speakers required in all interior spaces.

2.2 SPEAKERS – EXTERIOR

A. Exterior speakers required in all exterior spaces and must be exterior/outdoor rated.

2.3 WIRES AND CABLES

A. Provide all wiring, cabling, etc. required for interconnection of equipment and connection from equipment to speakers as required for a complete and operational system.

B. Provide outdoor rated cable where installed in wet locations, in underground raceway, or between buildings.

C. Provide additional pairs of wires where required for volume control priority relay override.

D. Audio Enhancement amplifier network circuits must use unshielded twisted pair, 4-pair 100-ohm, Category 6, plenum and/or non-plenum, violet:
   1. The Siemon Company, Premium 6™, UTP, 4-pair cable.
      a. Plenum: Part #9C6P4-E3-08-RXA (violet).
      b. Riser: Part #9C6R4-E3-08-RXA (violet).

E. CAT6 patch cables:
   1. The Siemon Company
      a. At patch panel: Part #MC6-01-08 Violet.
      b. At device endpoint: Part #MC6-07-08 Violet.

2.4 PATCH PANELS, MODULAR FACEPLATES, AND MODULES

A. Patch panels (serving closets):
   1. Manufacturer: The Siemon Company.
      a. Model # UP6-F1-24K-RS, Copper, Patch Panel, Ultra MAX, with Jacks, UTP, Category 6, 24 Port, Flat, 1U, Black, Detached Wire Manager
      b. Model # UP6-F2-48K-RS, Copper, Patch Panel, Ultra MAX, with Jacks, UTP, Category 6, 48 Port, Flat, 2U, Black, Detached Wire Manager

B. Patch panel labels (serving closets):
   1. Manufacturer: The Siemon Company.
      a. Part # Z-PNL-PS holder and Z-PNL-PL48 labels.

C. Modular faceplates (classrooms and device endpoints):
   1. Manufacturer: The Siemon Company.
      a. Model # KSM1-02-NN, Surface Mount Box, Keystone, 1 Opening, Key, White

D. Modular faceplate color icon indicator:
   1. Manufacturer: The Siemon Company
      a. Part # Z-ICON-08-B violet.

E. CAT6 Modules
   1. Manufacturer: The Siemon Company.
      a. Ultra MAX Model # U6-H08NS, Copper, Outlet, Ultra MAX, UTP, Category 6, RJ45, Hybrid, Violet, Punch down, T568A/B

2.5 WIREMOLD AND RACEWAYS

A. Where cables cannot be hidden in-wall, the following Wiremold is to be used (only for retro fits, not permitted in new construction):
   1. Wiremold 5000 series - Device Mounting Bracket with applicable hardware.
   2. Raceway parts as required by same manufacturer.

2.6 TERMINAL CABINETS

A. Provide terminal cabinets, as noted on drawings at each building complete with terminal strips, backboard, surge suppression equipment (where specified) ground lug, and #6 ground wire to power service ground for all 70v speakers.

B. Terminal cabinet to be Square "D" or Hoffman.

2.7 TERMINATION BLOCKS

A. 66 Type:
   1. General:
      a. Unit to be MI-50 type punch down block.
      b. UL listed.
      c. Sized for 50 pair, 14 AWG through 26 AWG conductors.

d. Impact resistant molded housing.

e. Mounting feet.

2. Units with surge suppressor:

a. Provide unit as specified above with Ground Rail, EDCO #MGB.

2.8 SURGE SUPPRESSION

A. Must be UL 497B listed and labeled.

B. Multi-stage hybrid protection circuit for call-in circuits, and power circuits. Single stage is acceptable for speaker circuits.

C. Plug-in replaceable modular design or individually mounted units.

D. Fail short/fail safe.

E. Surge capacity: 500 amp with 10 x 700µs waveform.

F. Clamp voltage: 150% of circuit peak operating voltage with 100-amp 10 x 700µs waveform.

G. Maximum continuous operating voltage: 125% of peak operating voltage, minimum.

H. All 70v speaker circuits shall be surge suppressed.

PART 3 – EXECUTION

3.1 GENERAL

A. The contractor is advised that circuit routing for this system is not necessarily shown on the project drawings. The contractor shall provide and install all raceways, wiring and cabling required for a complete and fully functional system as intended by these specifications. All pathways, penetrations, etc. for the intercom system must be dedicated and not shared with any other low- or high-voltage systems. All backbone cabling shall be in conduit, unless noted otherwise. Contractor shall provide and install a properly sized, flush mounted outlet box for every device, unless a retrofit install is taking place and the wall is impenetrable. Contractor shall provide and install, within the wall, a properly sized conduit extended above ceiling and turned into room it serves for each device. Contractor shall size and route raceways to accommodate the proper installation of the system cabling. T-Tapped cabling shall not be acceptable. In locations where raceway and/or conduit is not accessible after completion of the project, conduit shall be routed from device to device or fire rated access panels shall be installed to provide access to junction and pull boxes. Routing of raceway from device to device shall only be acceptable where the wiring scheme of the system, as recommended by the manufacturer, requires cable to pass from device to device. Contractor shall properly terminate each device according to the manufacturer’s recommendations. Station/device cabling for this system shall be installed in J-Hooks. Provide and install fire-rated sleeves where penetrations are made through rated walls and floors.

3.2 SYSTEM PERFORMANCE

A. Upon completion, the system shall be clean, properly adjusted, and in perfect operating condition.

B. The system shall be free of any audible components of hum, noise, or distortion.

3.3 EQUIPMENT MOUNTING

A. All non-end-user interactive intercom equipment (70v amplifiers) to be located in MDF and IDF closets, confirm location with Owner.

B. All equipment and associated wiring shall be installed in a neat manner and firmly secured in the console with appropriate hardware or to ceiling/wall.

3.4 CONSOLE TEST, SHIPMENT, AND ACCEPTANCE

A. Upon completion of the connection of the building cable network, the system shall be fully tested from each administrative console or phone location. The system shall be capable of self-testing and reporting all fault conditions.

3.5 PATHWAY

A. General:

1. Provide and install raceway for all surface mount speaker installations to non- exposed location, penetrations of fire rating assemblies/walls/etc., where exposed to damage, exterior locations, underground locations, interconnection of CC's, CP's, and CER's, or any combination thereof, for all backbone cables, and all areas required by applicable codes and standards or as otherwise noted/required in these specifications.
2. All pathways, penetrations, etc. for the intercom system must be dedicated and not shared with any other low- or high-voltage systems.
3. Where acceptable to authority having jurisdiction and all applicable codes/standards, cables above accessible ceilings may be run without raceways provided complete installation complies with all applicable codes/standards. Proper cable type, sleeves and support hardware must be utilized.
4. All raceways shall terminate at point within 12 inches of termination point terminal block with appropriate grounding bushing.
5. Raceway shall not be shared by power or any other electrical wiring that is not part of the low voltage Intercom system. Intercom system wiring may be installed in underground pull boxes with other low- voltage systems provided:
    a. Installation meets/complies with all applicable codes and standards.
    b. Intercom system cables are separated by at least 12 inches from any non-shielded voice/telephone/PDS wire/cable.
6. Bend raceway with minimum inside radius of 6 times the internal diameter. Increase bend radius to 10 times for raceway larger than 2-inch size. Provide proper bend for all changes of direction. Pull and splice boxes shall not be used in lieu of a bend.
7. Install raceways so no more than two 90o bends are in any raceway section without pull box. Install additional pull boxes as required to maintain maximum of two 90o bends between pull boxes and/or termination points.
8. Label all raceways at both ends to indicate destination and intercom system source room. Also indicate length of raceway and this labeling/identification shall be fully documented in as-built (record) drawings.
9. Install polyethylene pulling string in each empty conduit over 10 feet in length or containing a bend.
10. Properly support cables/wire not installed in raceways.
11. Special Raceway Systems: Special raceway systems may be specified for some portions of the intercom system. Refer to the drawings and other sections of these specifications to determine where or if such systems are used.
12. Pathways/raceways at terminal board locations shall be neatly racked on a Kindorf type rack secured to wall above and below terminal boards.

B. Horizontal Cable Pathway:

1. Sleeves:
    a. Install rigid steel conduit sleeves with bushings on both ends at penetration of all walls above ceilings. Stub-out each side of wall a minimum of 12 inches.

b. Size sleeves as required by the NEC for cable installed, but in no case shall sleeve be less than 2-inch diameter, nor smaller than that required by “c” below.

c. Sleeve size shall not be smaller than that required by EIA/TIA-569, Table 4.1- 1, "Conduit Sizing."

2. Cable Support:

a. Install J-Hooks located 48 inches to 60 inches on center above accessible ceiling areas for cable support.

b. Where large quantities of cables are congested in an area such as near CC or CER, provide/install special supports designed to carry weight.

c. Size shall be as required to provide for cables installed plus 50% spare and still not exceed rating of support device.

d. Tie all cables to J-Hooks at all bends with ties approved for use.

3. CC/CER Termination Locations:

a. Install vertical wireway from within 12 inches of all termination blocks to ceiling space.

b. Size wireway as required for cables and meet percent fill requirements of applicable codes/standards.

c. Provide bushings on each end of wireway.

4. CP Termination Locations:

a. Install wireway from CP to ceiling space as called for CC/CER locations, but terminate wireway at CP.

C. Backbone Pathways (Intrabuilding or Interbuilding):

1. Install raceways as required above under "General."

2. Minimum size: 1".

a. Increase size of conduit/raceway/pathway called for above if larger size is called for on drawings or larger size is required per paragraph "b)" below.

b. Conduit/raceway/pathway size shall not be smaller than that required by EIA/TIA- 569, Table 5.2-1, "Conduit Fill for Backbone Cable." Conduit size shall be based on type of cable and quantity of cables.

D. Pull boxes, Splice (Junction) Boxes, Outlet Boxes:

1. Install per applicable sections of these specifications and all applicable codes/standards.

2. Boxes shall be placed above accessible ceilings and in an exposed manner and location, and readily accessible. Boxes shall not be placed in a fixed false ceiling space unless immediately above a suitably marked and rated hinged access panel.

3. A pull or splice box shall be placed in a conduit run (within buildings) where:

a. the length is over 100 feet, or

b. there are more than two 90 o bends, or

c. there is a reverse bend in the run.

4. Boxes shall be placed in a straight section of conduit and not used in lieu of a bend. The corresponding conduit ends should be aligned with each other. Conduit fittings shall not be used in place of pull boxes.

5. Outlet boxes shall be installed at speakers requiring outlet box per applicable codes/standards.

6. Provide bushed nipple at speakers receiving cable without raceway/conduit.

7. Every pull box and/or splice box shall have a hinged cover. Install appropriate access panel to allow cover to open.
8. Where a pull box is required with raceway(s) smaller than 1-1/4 trade size, an outlet box may be used as a pull box.
9. Where a pull box is used with raceway(s) of 1-1/4 trade size or larger, the pull box shall:
    a. for straight pull through, have a length of at least 8 times the trade size diameter of the largest raceway.
    b. for angle and U pulls, have a distance between each raceway entry inside the box and the opposite wall of the box of at least 6 times the trade size diameter of the largest raceway, this distance being increased by the sum of the trade size diameters of the other raceways on the same wall of the box; and
    c. have a distance between the nearest edges of each raceway entry enclosing the same conductor of at least:
        i. Six times the trade size diameter of the raceway; or
        ii. Six times the trade size diameter of the larger raceway if they are of different sizes.
10. For a raceway entering the wall of a pull box opposite to a removable cover, have a distance from the wall to the cover of not less than the trade size diameter of the largest raceway plus 6 times the diameter of the largest conductor.
11. Where a splice box is used with raceway, it shall be sized per EIA/TIA-569, Table 4.4-2, "Splice Box Sizing."
12. Where a splice box is used with raceway, it shall be sized per EIA/TIA-569, Table 4.4-2, "Splice Box Sizing."
13. No box shall be smaller than that required by NEC 314-28 (a), (1) and (2).

3.6 GROUNDING

A. Provide and install complete grounding system as required to comply with all sections of these specifications and applicable codes.
B. Connect each Central Equipment rack to "systems" ground bus with #6 green insulated copper ground wire.
C. Connect metal conduit (via grounding bushing) to "systems" ground bus.
D. Connect cable shields to "systems" ground busbar.
E. Connect surge suppression equipment to "systems" ground busbar.

3.7 SPEAKERS

A. Mount ceiling speakers in or on ceiling system at locations shown on drawings as directed by ceiling system contractor, manufacturer, and installer. Provide all required mounting hardware and/or accessories. In general, all speakers shall be recessed mounted in the ceiling system. Wireway speaker cannot be recessed; install surface speaker assembly.
    1. Speakers mounted in acoustical tile ceilings shall have an integrated support bridge.
B. Mount exterior speakers' surface on wall at locations shown on drawings.
C. Connect speaker circuits and program speaker circuits to form the following zones:
    1. Classrooms
    2. Corridors
    3. Exterior
    4. Administrative

5. Multipurpose
6. Media Center
7. Car line
8. Bus loop
9. Spare
10. Spare

D. Each speaker circuit shall have a separate, splice-free cable homerun to the termination block in the local Terminal Cabinet

3.8 CALL-IN SWITCH

A. Install call-in switch at locations shown on drawings.

B. Connect each call-in switch to control intercom call-in circuit in room speaker circuit shown.

3.9 ADMINISTRATIVE TELEPHONE

A. Install administrative console at locations shown on drawings.

3.10 CABLE AND WIRE

A. Splice cable only at terminal block units.

B. Make cable shields continuous at splices and connect speaker circuit shield to equipment ground only at building surge protection devices and at amplifier and/or as otherwise required by applicable codes.

C. Install input circuits in separate cables and raceways/pathways from output circuits.

D. Install all cables no closer than 12" from any wire/cable installed for Premise Distribution System, power system cable/raceway, or fluorescent/ballasted light fixtures.

E. Leave 12 inches excess cable at each termination at speaker and termination blocks.

F. Leave 6 feet (2 M) excess cable at each termination at system equipment/rack.

G. Provide protection for exposed cables where subject to damage.

H. Support cables above accessible ceilings to keep them from resting on ceiling tiles. Use J-Hooks to support cables. Do not share J-Hooks of Premise Distribution Wiring System. Provide quantity of J-Hooks as required to provide 50% spare capacity at all J- Hooks.

I. Use suitable cable fittings and connectors.

J. Connect speakers to local 66 type terminal blocks at local CC (or CER) using Intercom system horizontal copper shielded cable.

K. Connect 66 type terminal blocks of CCs to main distribution type terminal blocks at CER using Intercom system copper backbone cable. Size conductor for voltage amp/load. Provide quantity of pairs of conductors as required to comply with speaker circuiting as specified herein.

L. Connect main distribution 66 type terminal blocks at CER to Intercom and Master Clock System central equipment using Intercom and Master Clock System horizontal copper shielded cable, pairs as required.

M. Connect Intercom system central equipment to PBX system using UTP category 3 cable for two telephone line connections.

N. Install appropriate cable to match application, i.e., plenum, riser, etc. All cables shall bear CMP and/or appropriate marking for the application in which they are installed.

O. Label cable at both ends indicating the originating and terminating location of each end. This labeling/identification shall be fully documented in as-built (record) drawings.

3.11 FINAL

A. As built drawings shall be given to operation persons at time of instruction, in addition to those to be supplied as general requirements of the job.

B. Final level adjustments shall be made after occupancy.

3.12 CABLE IDENTIFICATION

A. Provide and install permanent cable markers on all cables, speaker lines, telephone lines, etc. at terminal strips, terminal cabinets and at console.

B. CAT6 network drops should be labeled as such at the patch panel:

1. Utilize the specified patch panel labels in section 2.4.
2. Label for each channel should indicate which room number the channel terminates in (work area outlet).

C. CAT6 network drops should be labeled as such at the work area outlet:

1. Use color icon specified in section 2.4 at the WAO.

3.13 PROGRAMMING

A. All programming shall be as directed by the owner. All classrooms shall initially be programmed as staff stations.

END OF SECTION

SECTION 27 51 23 - INTEGRATED IP BASED SAFETY & INTERCOMMUNCATION SYSTEM WITH CLASSROOM SOUND ENHANCEMENT AND DIGITAL DISPLAYS.

PART 1 - GENERAL

1.1 DESCRIPTION

A. The requirements of the contract documents, including the General and Supplementary General Conditions and Division 1 - General Requirements shall apply to the work of this section.

B. At the time of proposal, any exceptions taken of these specifications, all variances from these specifications and all substitutions of operating capabilities or equipment called for in these specifications shall be listed in writing and forwarded to the Architect / Engineer. Any such exception, variances or substitutions which were not listed at the time of bid and are identified in the submittal, shall be grounds for immediate disapproval with comment.

1.2 SCOPE OF WORK

A. The work covered by this section of the specifications shall include all material, labor, hardware, software, firmware and programming to install a completed operating system as described herein and shown in the drawings. The system shall utilize the school's shared data network, and not require the use of any proprietary switches, routers, or other network components. The physical network components shall be provided by the owner or the contractor, the scope of this document does not include the physical network including switches, routers, or network cabling. Beyond the shared data network hardware, the rest of the system shall be complete with all necessary materials, labor, hardware, software, firmware and programming specifically tailored for the installation. It shall be possible to permanently modify the software on site by using a system administrator software network interface.

B. The intent of this specification shall maximize communications between the classroom and administrative areas utilizing VoIP (Voice over Internet Protocol) Technology while enhancing school safety and reducing maintenance, operational, and installation cost. Intended system shall integrate seamlessly as a complete system for local sound reinforcement as well as supporting intercom, paging, and bells functionality.

C. Under this specification, the system shall provide a complete VoIP Communication System for all classrooms and flex spaces as indicated on the drawings. An analog solution using speakers and volume controls in the offices, corridors, exterior locations, restrooms, gymnasium, cafeteria, and ancillary support buildings shall also be part of this project.

D. System shall support strobes or Visual Messaging Displays to alert of notifications as an integrated component of the system.

E. The Communication System shall provide VoIP or network distribution of intercom, overhead paging, emergency paging, class change time tones, emergency tones and program material. The system shall also support visual messaging that will match the audible messages from the system including automated setup of the devices.

F. Any and all miscellaneous materials, labor, hardware, software, firmware and programming that is not listed in the specification section that is required to provide a complete operating system shall be provided as part of the scope of work for this installation.

G. The work covered by this section of the specifications shall be coordinated with all trades that are affected by the installation of this system. All work shall be complete and as required and specified elsewhere under these project specifications.

H. All the actual required system components and cabling are not shown or specified as this caries between acceptable manufactures and suppliers. It shall be the responsibility of the contractor to obtain this information from the acceptable supplier and or manufacturer and include the cost of the same in his bid.

1.3 APPLICABLE CODES AND STANDARDS

A. Any devices that are subject to UL (Underwriters Laboratory) requirements using high voltage will bear the UL Label.

B. The system shall be installed in strict accordance with all the requirements of the National Electric Code.

C. The system shall be installation in strict accordance with the requirements of the Americans with Disabilities Act (ADA).

D. The system shall be installed in strict accordance with the requirements of all other applicable codes as well as all Federal, State, and local codes.

1.4 RELATED DOCUMENTS

A. Secure all required permits and approvals prior to installation.

1.5 RELATED WORK

A. The contractor shall coordinate work in this section with all related trades that the system effects of integrates with. Work and / or equipment provided in other sections and related to the system shall include but not be limited to the following:

1. Cable support system
2. Structured Cabling System installer
3. Network Infrastructure Supplier - switches/routers

1.6 SUBMITTALS

A. Furnish to the Architect / Engineer complete equipment submittal technical specification sheets and shop drawing submittals in .pdf format for this system including but not limited to the following:

1. A material list with the quantity of each piece of equipment, names of manufacturers, model numbers and the technical data information on all equipment the contractor proposes to install. This material list shall be broken out and listed by Specification Section, per piece of equipment. If a piece of equipment is needed but not listed in this specification section, it shall be listed in the area of the submittal it pertains to. The technical information shall be a piece of the manufacturer's printed literature that is produced by the equipment manufacturer. Internet web page listings will not be accepted. Provide a description of any special installation procedures that will differ from what is specified or shown on drawings.
2. Compete system circuit diagrams of the entire system, point to point on scaled floor plans scaled to match that of the scale of the project documents. The shop drawings are required to clearly illustrate how all components are related to each other and how they interconnect to each other. A complete point to point wiring diagram of any and all panels and how they interconnect with all the components and or devices that are part of the system as well as any ancillary devices that are being provided by other trades. All cables run shall be shown of the shop drawing submittals. Cable tags shown on the shop drawing submittals shall correspond with cable tags that are located inside equipment enclosures as well as documented on the as-built drawing. The shop drawing submittals shall include scaled drawings of all racks, panels, consoles and special assemblies. The show drawing shall include all circuit numbers of all cables and terminal connections as well as how they are labeled. Each drawing shall have a descriptive title and all subparts of each drawing shall be completely described. All drawings shall have the name of the project, Architect / Engineer and contractor in the title block. The floor plans, rooms names and numbers for the submittal drawings shall match that of the project documents. The symbol used on the submittal drawings shall match that of the project documents. The only information to be shown on the submittal drawings for this Specification Section shall be information that pertains to the system that is being submitted on.

3. Provide a detailed custom description of the operation of the submitted system for this installation and a statement listing every technical and operation parameter wherein the submitted equipment varies from what was originally specified. If the submitter fails to list a particular variance and his submittal is accepted; but subsequently, deemed to be unsatisfactory because of the unlisted variance, the submitter shall replace or modify such equipment at once without cost to the Owner. A letter or certificate from the manufacturer stating that the system contractor is an authorized distributor and installer of the submitted equipment shall be supplied.
4. The contractor shall be responsible for providing to the Architect / Engineer any and all additional information required and as deemed necessary by the Architect / Engineer for submittal and shop drawing submittal review.

1.7 QUALITY ASSURANCE

A. This specification section shall be a 1 manufacturer responsibility or as specified herein with no exceptions. Any variances to this specification item shall be submitted to the Architect / Engineer 10 working days prior to proposal for review by the Architect / Engineer. The equipment manufacturer for this specification section has been in business manufacturing the specified equipment for a minimum of 10 years.

B. The contractor shall be the factory authorized and factory certified distributor and installer of the equipment to be provided for this specification section. The installation contractor’s factory certification shall be submitted to the Architect / Engineer as part of the contractor’s subcontractor and materials list at the time of the bid as well as with the ship drawing submittal.

C. The contract for the systems described herein shall be assigned to the general contractor for the building construction. The intercommunication system contractor shall coordinate all work and work sequencing with the general contractor.

D. Owner and Architect / Engineer Inspections: The Owners technology staff and Architect / Engineer shall provide advice as requested. The Owners' technology staff shall inspect the project as the work progresses. Prior to final acceptance of the work, the Contractor shall decide with the appropriate authorized Owner personal to inspect the construction areas, both to ensure satisfactory completion of the work and to ensure complete cleanup and restoration of areas affected by the work. Temporary protection, coverings, and structures shall be removed at or before the time of inspection.

1.8 CIRCUITING GUIDELINES

A. All wiring shall be Cat. 6/6a for connections to speakers, call switches, etc. for future migration to a complete IP (Internet Protocol) based intercom paging system. Cabling from the MDF or IDF to each classroom enclosure shall be provided by others. A patch cable, providing connectivity from the work outlet faceplate to the MS-500 shall be provided by others to the AV contractor for connection to the network.

B. Each classroom / education space to have a dedicated network connection to the intercom paging system head-end to provide 2-way communications from the integrated paging system console as well as the district IP based phone system.

C. Each office / administrative space to have 1-way communications from the paging system and is capable to being addressed from the building telephone system handset.

D. Each corridor / common space / exterior space including library, cafeteria and gymnasium to have 1-way communications from the paging system and be capable of being addressed from the building telephone system handset.

E. All wiring shall be in accordance with the manufacturer's specifications and certified for performance.

1.9 SEQUENCE OF OPERATIONS

A. The ability to be distributed via a fiber 10/100/1000Mb switched, VLAN enabled network or 10/100/1000Mb switched stand-alone intercom network. It shall be possible to eliminate the need for copper feeder cables between the Main and Intermediate distribution frames using fiber optic cabling.

B. Shall have SIP (Session Initiation Protocol) Integration to connect all talk-paths to the VoIP phone system of choice. This shall support registering as an extension on the system or through the use of a SIP Trunk.

C. The system shall provide the ability to support a SIP tunnel from the building's VoIP phone system to provide two-way communication from all administrative telephones to any location equipped with a talkback speaker or audio system with room microphone.

D. System shall interface with any VoIP telephone system using SIP type integration thus allowing the school(s) to upgrade or replace their telephone system without suffering a requirement to replace, or lose any feature of, their internal communications (intercom) system. Any system that limits system features based upon any selected telephone system and is not SIP based shall not be acceptable.

E. The system shall have the ability to call 911 or any other programmed number/extension from the classroom as a part of the intercom communication system giving opportunity of messages to identified individuals or groups.

F. System alerts must be able to be self-configured and triggered from both classroom and headend. Alerts for example are medical, lockdown, evacuation, hold in place, disturbance, etc.

G. Automatically sound a tone or play a pre-page WAV file over any loudspeaker connected for two-way communication to alert the classroom teacher that this 2-way call has been established. This is intended to prevent unauthorized monitoring.

H. Distribution of emergency announcement(s) from any authorized telephone to all areas furnished with a loudspeaker. Emergency announcements shall have the highest system priority

I. Distribution of general announcements from any administrative telephone, staff telephone, or classroom telephone. The system shall be capable of providing all-call, group call, or multiple group call.

J. Classroom speakers or audio systems with room microphone shall be software assignable to unlimited paging groups.

K. Provide the ability to define and archive unlimited schedules with up to three hundred (300) events per schedule. Each scheduled event shall be capable of activating included tones or playing custom audio/voice phrases or controlling any I/O port on a system network interface for building control and scheduled along with a bell. Schedule administration, modification and creation functions shall be available through web access on remote computers and mobile devices.

L. The system shall automatically make audible messages display on scrolling LED displays as needed with no additional programming.

M. The system shall support a strobe light to be used in conjunction with audible messages for loud areas.

N. The system shall provide an administrative console for the front office, consisting of a touch screen interface no less than 22" diagonal interface.

O. The system shall support CAP and allow for API interoperability such as gunshot detection, weapon detection, vape detection, and other 3rd party hardware.

P. The User Interface shall be map based and support full touch operation. The manufacturer shall provide the ability to take a map in any format, including paper copy, PDF, Visio, etc. and create from that the map used for the primary user interface. Non-map-based User Interfaces will not be considered.

Q. The WAV or MP3 files shall be activated via the administration software, telephone and / or telephone system and / or pushbuttons.

R. The system must allow 3rd party IP Cameras integrations into the system map to display during emergency events.

S. The system shall be capable of dynamic room/zone paging.

T. The WAV or MP3 files shall be programmable as to what level of priority they can be broadcast. They shall be programmable to override any class change tones, normal all call, music, and intercom in the event of an emergency.

U. The WAV or MP3 files shall also have the ability to be broadcast into any one or all of the zones with the system. Simultaneous playback of different audio to different zones must be possible.

V. The WAV or MP3 files shall have the ability to be broadcast via a schedule for any day of the week or time of the day. They shall also have the ability to be broadcast for any duration of time and repeat number of plays with the ability to select how long the duration is between each repeated broadcast.

W. The WAV or MP3 files shall also have the ability to be a part of the classroom change tones within the system. These files shall be able to replace any tone within the class change schedules so as to offer the flexibility of customizable tones and or phrases in this class change mode.

X. It shall be possible without the cost of additional hardware/software to incorporate a LAN / WAN district wide paging system by means of the built in VoIP district Paging Adapter or district software. This adapter shall give the district the ability to page each school independently, as a group of schools, or all schools.

Y. The system shall be capable of automatically listening into a classroom in the event of an alert or lockdown.

Z. The system shall allow for the integration of changeable message signs to support bells and notifications. These signs shall be multi-color, multi segment LED scrolling displays and powered and controlled via a network PoE (Power over Ethernet) connection.

AA. The system shall also allow for the integration of third-party system through the use of contact closure, TCP (Transmission Control Protocol) communication, RS-232 communications and HTTP (Hypertext Transfer Protocol) communications.

BB. The system shall support and allow for devices to be managed within the system itself including device discovery, automated programming and automated assignment to rooms and zones.

CC. System must support device programming templates per device per site and support making individual adjustments to those templates on a per device basis and that setting would supersede the template for that device only.

DD. System shall support monitoring and upgrading firmware of supported devices.

EE. System shall support management of IP based PoE visual message displays and automate the programming of devices through the interface including automatically applying visual messages for bells and notifications without the use of a secondary application or software.

FF. The system shall support door status monitoring with alerts and warning based on defined times. There must be the ability to bypass reporting based on bell schedules and special events.

GG. The system shall support desktop announcer in which teacher and student windows and mac OS computers can display critical emergency alerts through a post message delivered through the headend application.

HH. The system shall support an automated commissioning function that allows the system to be placed into a test mode and monitors and reports the commissioning status of the devices.

II. System shall support a district server that will allow for management and monitoring of all schools in the district. Server must support physical and virtualized server deployments. The district central server will allow for centralized paging to entire district, groups of schools or individual schools. Server will support the ability to record and preview the page before it sends to the sever. Server will also support sending notifications to a school, group of schools or entire district. Server will support defining associated campuses for schools to automate events and notifications at those sites. Shall support centralized reporting of alerts and allow to directly interact with alert. Server interface shall be map based and support nested maps allowing for closer detail on an area or grouping of schools. District server shall support monitoring servers and devices at campus and alert via UI on any degraded or offline devices. Server shall support direct access of campus servers through single pane of glass and will not require authenticating into individual sites.

1.10 WARRANTY

A. The manufacturer and installation contractor shall guarantee the system, equipment and all its components for a minimum of 1 year from date of final acceptance of the system as documented by the Architect / Engineer. This guarantee shall cover the replacement of all parts and labor to replace the same made necessary by normal usage and wear.

B. Upon completion of the installation of the system, the contractor shall provide to the Architect / Engineer and Owner a signed written statement, on company letterhead, substantially in form as follows: “The undersigned, have engaged as the Intercom paging system contractor for the building project confirms that the system was installed in accordance with the wiring diagrams, instructions and directions provided by the manufacturer.”

C. Contractor shall repair, adjust, and / or replace, whichever the Owner and / or Architect / Engineer determines to be in its best interests, any defective equipment, materials, or workmanship, as well as such parts of the work damaged or destroyed by such defect, during warranty period, at the contractor’s sole cost and expense.

D. In the event that any of the equipment specified, supplied, and / or installed as part of the work should fail to produce capacities or meet design specification as published or warranted by the manufacturer of the equipment involved or as specified in this document, the contractor shall, in conjunction with the equipment manufacturer, remove and replace such equipment with equipment that will meet requirements without additional cost to the Owner.

1.11 TRAINING AND INSTRUCTION FOR OWNER MAINTENANCE

A. A training program including a minimum of 4 hours on the use of the system shall be provided to the Owner to use at their discretion. A full and complete overview of the system shall be included in this training as well as any literature required by the Owner to allow complete and total use of the system by the Owner’s designated staff. System maintenance requirements for the equipment will also be documented and turned over the Owner. User and help videos shall also be made available to the customer via USB thumb drive or via an online fashion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. The following manufacturers are approved to submit proposals for this project:

1. Audio Enhancement - EPIC (Education Paging & Intercom Communications) System

2.2 EQUIPMENT

A. INTERCOM PAGING SYSTEM:

1. The system shall be a software-controlled system, whose primary interface is a web-based portal, accessible from any authorized computer. The system shall support being deployed on physical server hardware or through vitalization on the customer’s hardware. For the physical server, the system shall utilize a 1U rack server, operating as an appliance, dedicated to the operation of the IPB (Intercom Paging and Bells) & SAFE (Signal Alert For Education) System only. The rack server shall have industry standard redundancy,

including RAID1, Dual Power Supplies, and hot swappable hard drives. The entire system shall be Linux based. If virtualized the system shall support VMWare ESXI version 6.5 or later.

2. The system shall be based on standards compliant SIP and RTP communications across the network and shall allow direct Trunk Integration to the VoIP telephone system.
3. The system shall provide a simple calendar-based scheduling system for bells. It shall provide the ability to have an unlimited number of bell schedules.
4. The system shall provide a map-based User Interface. All major functions, including Intercom, Paging, Notifications and Alerts shall be done using the map as the foundation for those actions. Paging shall clearly show on the map where the page audio will be transmitted to.
5. Bell Schedules shall be easily assigned to days and changed simply with authenticated access to the system through any browser-based device. Bell schedules shall be able to be changed even if a current schedule is active in the system same day and apply immediately.
6. The system shall support utilizing a shared data network and support (VLAN [Virtual Local Area Network] enabled) or dedicated network as means of distribution for all voice overhead paging, emergency paging, emergency tones, intercom, and class change tones. System shall support routing of traffic across multiple subnets and network segments.
7. The system shall be capable of accessing remote classrooms (trailers, temporary classrooms etc.) via IP interface or room audio system with room microphone. This shall provide intercom, class change tones, emergency tones, and normal / emergency paging via a wired network to these remote locations.
8. Exterior speakers shall be capable of being on separate zones and programmed separately.
9. The system shall have the ability to synchronize to the same NTP server utilized for the Master Clock system.
10. The system shall have the ability to produce user defined tone signals for time tones or emergency tones.
11. The system shall have SIP Integration to connect all talk-paths to the VoIP phone system of choice.
12. The system shall provide the ability to support a SIP trunk from the building’s VoIP phone system to provide two-way communication from all administrative telephones to any location equipped with a talkback speaker or audio system with room microphone. The system shall interface with any VoIP telephone system using SIP type integration thus allowing the school (s) to upgrade or replace their telephone system without suffering a requirement to replace, or lose any feature of, their internal communications (intercom) system. Any system that limits system features based upon any selected telephone system and is not SIP based shall not be acceptable.
13. The system shall provide its own SIP environment, and in the case of a failure of the schools VoIP telephone system, be capable of operating completely independently for all functions, save access from the handsets connected to the schools VoIP system.
14. The system shall not be reliant on WAN or internet connectivity for operation.
15. The system shall provide web access, which will give ability to monitor operations and functions of the system.
16. The system monitors the status of all connected devices for health, SIP connectivity and connected devices including the XD receiver. If a device becomes in a degraded or offline state, the system will monitor a technical contact via email and or SMS as well as show status on the map of the console.

17. The system shall provide web-based off-site programming and diagnostics of the system. It shall also be capable of determining basic circuit faults.
18. The system shall have a Web based administration programming tool which allows the administrative personnel to easily manage Audio Sources, Class Change schedules, paging groups, time updates, holiday schedules and day/night mode operation from an internet browser. System shall support HTML5.
19. The system shall provide calendar-based scheduling up to four years in advance. The system shall be capable of displaying a fully year calendar and differentiating which bell program is scheduled to run on each day. The calendar shall be based on a standard school year and provide a selectable start month, for example, it can be configured to run from August to July.
20. The system shall be capable of being fully integrated with the school's existing LDAP (Lightweight Directory Access Protocol) or Active Directory system. Systems that do not provide LDAP or Active Directory integration shall not be considered.
21. The system shall provide discreet control over roles for the system. Roles shall be definable down to the individual feature level and provide the district with the ability to restrict or grant access to any roll individual features or groups of features.
22. The system shall provide web browser access to the system specifically for a teacher. Teacher access shall be assigned through LDAP or Active Directory. The Teacher screen shall provide information specific to the room that the teacher is assigned to. That information shall consist of, but not limited to, the next scheduled event for the room (Bell, Announcement, etc.), Audio/Visual Controls for their classroom technology, Teacher Name, Room Number, an Intercom Call button, and an Emergency call button.
23. The system shall have the ability to carry IP Communications to the edge of the classroom Audio/visual Systems. It shall be able to control connected A/V Devices, provided that those devices are controllable by RS-232
24. The system shall be based on a database structure, utilizing a robust commercially available database such as SQL (Structured Query Language).
25. The system shall provide 2-way handsfree communication in each classroom.
26. System Classroom and Common Zone network interfaces shall be capable of utilizing standard Cat 6/6a infrastructure for installation from the Telecommunications Closets only to the classroom and/or zone, thus allowing for only one type of wiring infrastructure within the school. Distribution of all voice signaling shall utilize a shared or dedicated network. Systems that require homerun, dedicated, 18 gauge shielded wiring shall not be acceptable.
27. The system shall provide a flexible and robust event engine. In addition to pre-programmed events and actions, the event engine shall be capable of accepting Java-based programming to accomplish advanced integrations and functions.
28. The system shall automatically broadcast page emergency instructions throughout an entire school when an alarm (e.g. lockdown, lockout, security, fire) is tripped or manually activated. The emergency instructions shall be preprogrammed and require no user intervention. The system shall provide redundant alarm annunciation over intercom/paging speakers and is not meant to replace primary fire alarm or security systems.
29. The system shall provide the ability for the school to upload their own recorded files for both Bell Tones, and Notifications
30. The system shall provide the ability to initiate school safety paging announcements, evacuation tones and take cover tones from any telephone within the facility or outside the facility to any other location within the facility or district.
31. IP-enabled two-way voice communication shall be available from any provided telephone or administrative console through any speaker in the system. This shall allow handsfree

communication to any classroom or any individual loudspeaker unit. A pre-announce tone shall sound immediately before the intercom path is opened.

32. The system shall provide a complete personal alert function for each teacher. The alert functionality shall be an integrated part of the administrative head end software and shall not require any separate application or hardware to support this functionality.
33. The teacher personal alert functionality shall be integrated into the classroom microphones and the teacher web screen.
34. The system shall be capable of displaying on the map the location of the alert in the case of a microphone that is within range of its paired receiver, or from the teacher's web access screen. The system shall also be capable of approximately locating the location of the alert in the case of a microphone that is not in range of its paired receiver. A system, either the microphone system, or the administrative system that is not capable of receiving an alert from a microphone that is not within range of its paired receiver shall not be considered.
35. Upon alert, the system shall have the ability to provide notification on the dedicated console at the front office, or on any other computer which is currently logged into the administrative interface and has the appropriate credentials. The system shall provide both an audible tone, and a change on the screen that clearly indicates that an emergency alert has been received.
36. Upon alert, the system shall also be capable of sending e-mail and SMS Text messages to the designated school personnel. These alerts shall include a web link to the administrative console.
37. If cameras are installed in the classrooms, the system shall be capable of showing a live video from the classroom that received an alert. This shall only be shown in the case of an alert where the microphone is within range of its paired receiver.
38. The system shall have the ability to acknowledge the receipt of the alert by changing the indicators on the classroom microphone receiver in the room where the alert was received from. In the case of an alert received from a microphone not in range of its paired receiver, no acknowledgement shall be sent.
39. The system shall have the capability of maintaining a record of all alerts that are received and provide appropriate school personnel with the capability to enter information about the alert, which shall be maintained in the systems database. That information shall also be made available to appropriate school personnel in the form of a report that shows all alerts that have occurred, their date, time, and the end alert information.
40. The system shall contain a rules-based integration engine that allows for input of TCP, HTTP, or Serial Data and allows for the parsing of data for actions or triggering other systems via TCP, HTTP or Serial.
41. The system shall support digital message displays that provide visual feedback in the form of scrolling messages via an LCD or LED display all controlled from the network.
42. The system shall allow for integration into the classroom audio system including teacher microphone as required by design. This includes integration to ensure that system notifications, pages and intercom calls take priority over classroom audio sources.
43. The system must include perpetual licensing and include all in version software upgrades at no additional cost.
44. The base functionality of the system including the map interface, intercom, paging, bells, classroom audio control, SAFE System and Event engine must be part of the base licensing of the product and not require additional licensing.
45. The system shall have the ability to control signage displays for display of clocks, messages, digital signage, countdown timers as well as allow for automated messages to be displayed automatically for notifications.

46. The system will allow for the building of clock signs, message signs and notifications signs using the HTML EPIC interface allowing for using predefined templates and assets.
47. Clocks and emergency signs shall be a onetime perpetual license.
48. Server software shall require end user to create complex unique passwords for each system on first use. Systems that allow for generic or repeated passwords will not be acceptable.
49. System shall utilize a visual based event editor to define custom actions, inputs and outputs.
50. System shall support connection to District View Server for centralized management and licensing and services must be included as part of the system to support that connection, integration and programming.

B. INTERCOM PAGING SYSTEM NETWORK INTERCOM INTERFACE:
   1. Shall allow users to install intercom paging systems spanning multiple building or facilities connected through a VLAN.
   2. Network Requirements:
      a. 100/1000 Ethernet switch port configured on a dedicated VLAN.
      b. Systems requiring a specific network or subnet size are not allowable.

C. APC BACK-UPS, 6 OUTLETS, 425VA, 120V
   1. Output
      a. Output power capacity - 255 Watts / 425VA
      b. Max Configurable Power (Watts) 255 Watts / 425VA
      c. Nominal Output Voltage 120V
      d. Output Frequency (sync to mains) 50/60 Hz +/- 3 Hz Sync to mains
      e. Topology Standby
      f. Waveform type Square wave
      g. Output Connections (4) NEMA 5-15R (2) NEMA 5-15R
      h. Transfer Time 6 ms typical : 10 ms maximum
   2. Input
      a. Nominal Input Voltage 120V
      b. Input frequency 50/60 Hz +/- 3 Hz
      c. Auto-sensing Input
      d. Connections NEMA 5-15P
      e. Cord Length 4.99ft (1.5meters)
      f. Input voltage range for main operations 88 - 139V
      g. Number of Power Cords 1
      h. Maximum Input Current 5.0A
   3. Batteries & Runtime
      a. Battery type Lead-acid battery
      b. Typical recharge time 8hour(s)

D. APC SMART-UPS 1000VA, RACK MOUNT, LCD 120V WITH SMARTCONNECT PORT
   1. Output
      a. Output power capacity - 700 Watts / 1.0kVA
      b. Max Configurable Power (Watts) - 700 Watts / 1.0kVA
      c. Nominal Output Voltage - 120V
      d. Output Voltage - Distortion Less than 5 %
      e. Output Frequency - (sync to mains) 50/60 Hz +/- 3 Hz Sync to mains Other
      f. Output Voltages - 110, 125 Load Crest Factor 3 : 1
      g. Topology Line - interactive
      h. Waveform type - Sine wave
      i. Output Connections - (6) NEMA 5-15R
      j. Transfer Time- 6 ms typical : 10 ms maximum
   2. Input
      a. Nominal Input Voltage 120V
      b. Input frequency 50/60 Hz +/- 3 Hz
      c. Auto-sensing Input
      d. Connections NEMA 5-15P
      e. Cord Length 8.01ft (2.4meters)
      f. Input voltage range for main operations 75 - 154 Adjustable, 82 - 144V
      g. Number of Power Cords 1
      h. Other Input Voltages 110, 125
   3. Batteries & Runtime
      a. Battery type Lead-acid battery
      b. Typical recharge time 3hour(s)
      c. Replacement Battery APCRBC157
      d. Expected Battery Life (years) 4 - 6
      e. RBC Quantity 1
      f. Battery Charge Power (Watts) 112 Watts
      g. Runtime
         i. View Runtime Graph (Available in Technical Tab on site)
         ii. View Runtime Chart (Available in Technical Tab on site)
      h. Efficiency View Efficiency Graph (Available in Technical Tab on site)
   4. Communications & Management
      a. Interface Port(s) RJ-45 Serial, SmartSlot, USB
      b. Control panel Multifunction LCD status and control console
      c. Audible Alarm when on battery : distinctive low battery alarm : configurable delays
      d. Available SmartSlot™ Interface Quantity 1

5. Surge Protection and Filtering
    a. Surge energy rating 680Joules
    b. Filtering Full time multi-pole noise filtering : 0.3% IEEE surge let-through : zero clamping response time : meets UL 1449
6. Physical
    a. Maximum Height 3.39 inches
    b. Maximum Width 17.01 inches
    c. Maximum Depth 18.78 inches.
    d. Rack Height 2U

E. COMMON ZONE AMPLIFIER CZA-1300
1. LED Information
    a. AC Power
    b. Green - Powered On
    c. Orange - Standby Status
    d. Red - Booting
    e. Green - Ready
    f. GPIO - (General Purpose I/O)
    g. Yellow - Input Active
    h. Blue - Output Active
    i. White - Input & Output Active
2. 1 x 300W output
3. Built-in 70V
4. Space-saving 1 RU design
5. Control Port:
    a. (1) RS-232 Communication port to facilitate SAFE System Communications or 3rd party device control such as a projector
    b. (1) Remote Control Port: Integration with LCD Wall Plate
    c. (1) XD Port, RJ45
6. Ethernet I/F: 10/100 Mbs
7. Line Inputs
    a. For PC, DVD audio, MP3, auxiliary mic, or other multimedia sources
    b. (1) Unbalanced input (3.5mm)
    c. (2) Balanced inputs RJ45 connector
    d. Internal Network Audio
8. Line outputs
    a. (1) Unbalanced (3.5mm) output
    b. (1) Balanced line output (RJ45 connector)
9. Signal-to-Noise Ratio >89dB @ 20Hz - 20kHz at Maximum Output
10. Input Sensitivity 780mV
11. Output Power: (3) 24v RJ45
12. 5 Band Equalizer

13. USB: Control and configuration via software. BLE Dongle for easy setup
14. Power Supply
    a. 100V – 120V/240V - 240V @ 300W power amplifiers
    b. PoE (PoE 802.11 af) Powers all electronics except for the 70v Speaker out Amplifier
    c. Both AC Power and PoE Power must be connected for unit to operate
15. Operating Temperature/Humidity -32 - 122-degrees F / 10-90%
16. Storage Temperature -40-degrees C to 70-degrees C/10-90% non-condensing

F. INTERCOM PAGING SYSTEM POWER:
1. All Network interfaces used in the classroom and for the common zones shall be powered via PoE from the district provided network switches.
    a. PoE switches and network cabling from MDF (Main Distribution Frame) and IDF (Intermediate Distribution Frame) to devices provided by others.
2. All network switches shall include an uninterruptable power source to provide adequate runtime. In the event the school has a generator the UPS systems shall hold the switches long enough until generator power can be provided. Customer to provide all necessary UPS for network switches.

G. INTERCOM PAGING SYSTEM ADMINISTRATIVE KIOSK:
1. The administrative Kiosk shall be customizable, flexible and provide full access to the intercom paging system.
2. Kiosk shall be embedded Android OS into the touch screen and only display the intercom interface.
3. The supplier is required to provide a dedicated touch screen Kiosk for the front office, with a minimum size of 22 inches diagonally. The Kiosk shall not require the district to provide any additional hardware, software or licensing. The Kiosk shall also provide a boom microphone attached to the screen that wires directly to the Kiosk.
4. Administrative access to the system shall be browser based and shall also be capable of being any administrative computer.
5. Functionality to provide full access to all features such as all call, paging groups, emergency tones, control music, WAV file distribution, test rooms, crisis mode, schedules, etc.

H. NETWORK INTERFACE
1. Provide a Network Interface with performance as follows:
    a. Full-Duplex, Hands Free communications on Intercom Call
    b. Amplifier powered only by the PoE power source for emergency paging applications
    c. Mounting Bracket as required
    d. Connections - The following connections shall be available:
        i. Line Output for connecting to auxiliary amplifiers
        ii. 2 External I/O Connections - Terminal Block
            a) Ability to support relay output for interface into other systems.
        iii. RJ45 for PoE Network Connection
        iv. Serial interface for connecting to other equipment or SAFE Compatible equipment.

e. 1 speaker connection
   i. The system shall provide a speaker connection which is powered exclusively by the PoE power from the network
   ii. Can power up to 2 speakers per device.

f. Network Connection
   i. The system shall have a network connection with PoE power.
   ii. PoE shall be present on the system to provide power for the amplifier during a power emergency.
   iii. Shall support LLDP-MED for two level 802.3 power negotiation and device information.

g. Integrated Network Based Communications
   i. The System shall support the following protocols:
      a) Directed UDP (User Datagram Protocol)
      b) Unicast Audio
      c) Multicast Audio
      d) SIP
      e) TCP Control
         i) Integrated Serial Tunnel over TCP
         ii) The system shall have integrated SIP communications and be able to communication bi-directionally with any VoIP communications system that follows the standard SIP protocols
         iii) The system shall also have the ability to operate with multi-cast IP messages as well.
      f) Serial Gateway for Control via the network

I. CLAUDIA (CLASSROOM LINK ADVANCED UNIT FOR DELIVERY OF INSTRUCTION AND AUDIO) INTERFACE FOR FRONT OFFICE
   1. The program distribution panel shall provide inputs for audio signals from radios, MP3 players, CD players, etc.
   2. The program distribution panel shall permit adjusting the volume of each source and monitoring of the source at the panel.
   3. The program distribution panel shall be equipped with a 7 inch capacitive touch screen interface that provides control of the sources, and streaming functions into the paging system. 800X480 Resolution
   4. The program distribution panel shall provide Bluetooth® connectivity from a source device
   5. Two Line Level 3.5mm inputs
   6. Two Line Level 3.5mm outputs
   7. Powered via USB C
   8. Gigabit Ethernet Connectivity
   9. Delivers audio on demand or on schedule to MS-300/MS-500 Devices on Network from inputs within the unit including line level, preloaded, and Bluetooth.
   10. Can be scheduled and controlled as part of bell schedule within the EPIC system.

J. NETWORK INTERFACE FOR 2-WAY INTERCOM
   1. Line Input - Internal Network Audio Line

2. Outputs - 1 Unbalanced (3.5 mm) output
3. Minimum Load Impedance - 4 Ohms
4. Amplifier Type - 92% Efficient Class D for network audio only
5. Continuous Power @ 1% THD - 25 Watts powered by PoE†
6. S/N - >89 dB @ 20 Hz to 20 kHz at maximum output
7. Protection Circuits - Thermal and short circuit protected
8. PA Connector - Connects to public address system and mutes amplifier during announcements
9. Input Voltage - 4.0 Volts RMS to 74 Volts RMS
10. Control Port - RS-232, 3-pin screw terminal block header, RJ45 remote control port
11. RS-232 communication port
12. Intercom call, emergency alert, room microphone wall plate port (WPA-50x)
13. Input/output (I/O) aux port for sense, strobe, etc.
14. Power Supply - PoE + 802.3af/at†
15. Temperature/Humidity
    a. Storage: -40 to 1580-degrees F 10-90% non-condensing
    b. Operating: -32-1220-degrees F / 10-90%
16. Enclosure Type - Metal
17. Ethernet I/F - 10/100 Mbps
18. Power Input (Network) - PoE 802.3af/at†
19. Operating Temperature - 14 F to 1220-degrees F
20. Protocols
    a. SIP RFC 3261 compatible
    b. UDP Directed Broadcast
    c. Multi-cast and VoIP enabled
21. Lineout Output Signal Amplitudes - 2.0 VPP maximum
22. Output Level - +2 dBm nominal
23. Total Harmonic Distortion - 0.5% maximum
24. Weight 1.3 lbs. (589.67 g)
25. Dimensions 1.125 (H) x 9.19(W) x 3.56 (D) in.

K. NETWORK INTERFACE SAFE ALERT EXTENDER AND 2-WAY INTERCOM

1. Line Input - Internal Network Audio
2. Line Outputs - 1 Unbalanced (3.5 mm) output
3. Minimum Load Impedance - 4 Ohms
4. Amplifier Type - 92% Efficient Class D for network audio only
5. Continuous Power @ 1% THD - 25 Watts powered by PoE†
6. S/N - >89 dB @ 20 Hz to 20 kHz at maximum output
7. Protection Circuits - Thermal and short circuit protected
8. PA Connector - Connects to public address system and mutes amplifier during announcements
9. Input Voltage: 4.0 Volts RMS to 74 Volts RMS

10. Control Port - RS-232, 3-pin screw terminal block header, RJ45 remote control port
    a. RS-232 communication port
    b. Intercom call, emergency alert, room microphone wall plate port (WPA-50x)
    c. Input/output (I/O) aux port for sense, strobe, etc.
11. Power Supply - PoE + 802.3af/at†
12. Temperature/Humidity
    a. Storage: -40 to 1580-degrees F 10-90% non-condensing
    b. Operating: -32-1220-degrees F / 10-90%
13. Enclosure Type - Metal
14. Ethernet I/F - 10/100 Mbps
15. Power Input (Network) - PoE 802.3af/at†
16. Operating Temperature - 14 F to 1220-degrees F
17. Protocols
    a. SIP RFC 3261 compatible
    b. UDP Directed Broadcast
    c. Multi-cast and VoIP enabled
18. Lineout: Output Signal Amplitudes 2.0 VPP maximum
19. Output Level +2 dBm nominal
20. Total Harmonic Distortion 0.5% maximum
21. Weight 1.3 lbs. (589.67 g)
22. Dimensions 1.125 (H) x 9.19 (W) x 3.56 (D) in MS-375 Specifications*
23. Integrated XD Receiver Specifications
    a. System Frequency - XD Technology 1.9 GHz
    b. Coverage - Adjustable for optimal coverage from small classrooms to cafes, gyms, and other large spaces
    c. Microphone Type - Unidirectional electret condenser microphone
    d. Auxiliary Input Line level 35 stereo mini jack (monaural mix)
    e. Power Requirement - 24 VDC @ 130 mA Temperature Range 32-degrees F - 104-degrees F.

L. ANALOG INTERCOM SYSTEM CABLING:
1. West Penn
2. Belden
3. General Cable
4. Mohawk
5. Accepted substitute

M. INTERCOM PAGING SYSTEM VOLUME CONTROL:
1. Volume control shall be capable of controlling the volume of up to 150 1-way speakers.
2. Volume control shall be mounted on a brushed stainless-steel single gang wall plate with the plate being embossed with a dial scale of “0 through 10.”
3. Volume control shall be equipped with a skirted black knob with white position indicator.
4. Volume control shall include a stainless-steel mounting box and hardware.

N. INTERCOM PAGING SYSTEM CEILING SPEAKER.
   1. Ceiling Speaker Specifications
      a. Lay-in ceiling speaker shall consist of a white 13.5 inches grill, a speaker and integral back box or equivalent ceiling speaker with appropriate backbox, grille and tile bridge.
      b. Integrated 25/70/100V Transformer with tap settings accessible without disassembling speaker from 1.25W to 15W or 8Ohm bypass.
      c. The speaker shall be capable of handling minimum 50 watts continuous power.
      d. Sound pressure level at 1 meter on axis with a 1 Watt input shall be 96 dB.
      e. The frequency response shall be 86 Hz to 16 kHz.
      f. The baffle shall be constructed with a single piece of perforated steel with a white baked on acrylic enamel finish.
      g. Shall support seismic cabling from 3 points.
      h. The back box shall meet or exceeds UL 2043 for installation in a plenum space
      i. Approximate weight shall be 7.1 lbs.
      j. Basis of Design Audio Enhancement SP-0300.

O. INTERIOR INTERCOM PAGING SYSTEM SURFACE WALL SPEAKER:
   1. Wall speaker shall consist of a speaker and matched surface mount enclosure.
   2. The speaker, housing and hardware shall be electrically and acoustically matched for a frequency response of 65 Hz to 17 kHz.
   3. The speaker shall be 8 inches in diameter. and have a ceramic magnet weighing 4.8 ounces.
   4. Average sensitivity 92dB SPL, 1W/1M.
   5. Maximum output shall be 99dB.
   6. The baffle shall be constructed of 22 gauge steel with white baked hybrid epoxy.
   7. Maximum dimensions of the housing shall be 11 5/8” square and 4 1/8” deep.

P. INTERCOM PAGING SYSTEM PAGING HORN:
   1. The paging horn shall be a weather-resistant, high efficiency reentrant type horn speaker.
   2. The paging horn shall be equipped with an amplifier and externally accessible volume control.
   3. The paging horn shall include an adjustable swivel base.
   4. The frequency response shall be 275 Hz to 14 kHz.
   5. Dispersion shall be 90-degrees horizontal and 90-degrees vertical.
   6. Sound pressure level shall be 121 dB measured at 4 feet on axis with an input to the amplifier module being -10 dBm at 1 kHz.
   7. Distortion shall be less than 2.0% at rated output of 15 watts RMS.
   8. Input impedance shall be 600 ohms nominal.
   9. The amplifier shall operate on a -24 Vdc nominal, positive ground power supply.
   10. Operating current shall be 900 mA at -24Vdc
   11. Operating temperature shall be -4 to 131-degrees F.
   12. Operating humidity shall be 0-95% noncondensing.
   13. Dimension of the horn shall be 8” W x 8” H x 9:” D.
   14. Approximate weight shall be 4.0 lbs. (1.8 kg).

Q. INTERCOM PAGING SYSTEM VOLUME CONTROL
   1. The volume control must support a rotary selector switch with 11 positions.
   2. Volume control shall be white in color and be sized to fit a decora style plate.
   3. Inputs on control shall support incoming 25/70V signal on both the + and – with outgoing signal on + and -. Support for up to 12 AWG Wire.
   4. 25W RMS
   5. Basis of Design EPIC-V70v

R. CLASSROOM SOUND AMPLIFICATION SYSTEM (CSAS) EQUIPMENT: OPTIMUM AMPLIFIER WITH INTEGRATED XD RECEIVER:
   1. Provide a fully PoE Powered Receiver/Amplifier with ability to provide functions described above with performance as follows:
      a. Audio Power: 30 watts RMS mains powered amplifier
      b. 92% Efficient Class D Amplifier
      c. 1% percent THD across full frequency range of amplifier
      d. Frequency Response: 20 Hz to 20 kHz
      e. Power Requirements: PoE 802.3af/at 25.5W Maximum
      f. Shall support LLDP-MED for two level 802.3 power negotiation and device information.
      g. Signal-to-noise: >89dB
      h. Integrated mounting tabs
      i. Thermal and short circuited protected
      j. Integrated 3 channel DECT RF Receiver
   2. Controls:
      a. The primary control of the system shall be done through the teacher microphone.
      b. The following functions shall be available via USB connection for setup during installation:
         i. Input Control for multi-media sources and mixed XD source
         ii. Equalizer Controls
            a) 5 Band Digital Equalizer
         iii. Discreet Output volume controls for each input
      c. RS-232 Control
         i. Provide RS-232 control of the amplifier, and an additional RS-232 port which provides pass through control of a downstream device such as a projector
         ii. RS-232 processor shall be capable of differentiating between commands destined for the amplifier, and responding to those commands, and commands intended for the downstream and passing those commands through to the secondary RS-232 port
         iii. Command pass through shall be bi-directional
      d. Connections - The following connections shall be available:
         i. Four Multi-Media inputs
         ii. Dedicated Line output - for Assistive Listening Device Connection
         iii. Color Coded Connection
         iv. Ethernet Connection (8P8C RJ45 with PoE Power)

v. 8P8C RJ45 Connection for Intercom Paging Wall plate

vi. Support for Touch Based Wall Controller on Remote Port

vii. General Purpose I/O Output on 8P8C RJ45

3. Integrated DECT Technology RF Receiver The Receiver shall utilize DECT technology. DECT is a radio technology for voice applications. DECT is ideal for the classroom because the use of both frequency and time domain is ideally suited to smaller areas with a large number of users. In each classroom, it will be an independent system, with all necessary electronics to support the receiving & pairing functionality mounted on the wall near the amplifier or in the ceiling. The receiver will be connected to the amplifier through a universal twisted pair cable, using balanced audio connections. Power for the receiver shall be provided through the same cable as the balanced audio connections.

a. The receiver shall provide the following functionality. These features shall be included on board the receiver, and not require any external support to perform these functions.

i. Three Channel DECT based reception

ii. Pairing Button for Linking microphone to the receiver

iii. Remote control of all three microphone channels

iv. Advanced Feedback Blocker

a) The system shall have the ability to actively control feedback. This shall be done via an analog circuit that provides up to five active filters to control specific frequencies,

b) The Feedback Blocker shall also have the ability to lower the overall of the system by up to 6dB, during a user error situation where the overall system gain is manually turned up too high

c) The Feedback Blocker system shall automatically remove the filtering upon resolution of the user-initiated error condition

i) The Feedback Blocker shall be of an analog design - in order to avoid the detrimental effects of digital sampling, only analog systems shall be considered in order to implement this feature.

v. Emergency Alert Function

a) The system shall provide a trigger signal when the teacher presses and holds a button on her transmitter for more than two seconds.

b) The system shall be capable of providing a visual indication of three red LED’s when the teacher initiates a trigger signal

c) The system shall also be capable of receiving a trigger acknowledgement signal back from an external source, and altering the visual indicator from three (3) red LED’s to two green and one red LED

vi. Recording Function

a) The system shall provide for a secondary notification that can be used for future applications such as signaling an NDVR (Network Digital Video Recorder) to start a recording

vii. Control System Integration

a) The system shall have on board the capability of being controlled via RS-232 protocol.

viii. The system shall also have the capability of broadcasting RS-232 commands when the teacher presses the up/down volume controls on their microphone

b. Power Requirements: Integrated power from PoE, receivers requiring secondary power not allowable.

c. Operating Frequency - 1.9 GHz Band

d. Receiver Type: DECT

i. Controls: System shall have available the following controls

a) Channel 1 Volume Control - Fully controllable from the teacher microphone remotely through the DECT system

b) Channel 2 Volume Control - Fully controllable from the teacher microphone remotely through the DECT system

c) Auxiliary Input Volume Control - Fully controllable from the teacher microphone remotely through the DECT system

d) Alert Controls on Teacher Microphone - Two buttons on the sides of the microphone

e) Recording Control on Teacher Microphone - One button on the front of the microphone

S. TEACHER BODY PACK TRANSMITTER AUDIO ENHANCEMENT STM-24

1. Provide a body pack transmitter with performance as follows:

a. Operating frequency - 1.9 GHz - DECT

b. Audio distortion: <1.0% (±40kHz deviation @ 1kHz)

c. Integrated microphone

d. Internal charger circuit

e. USB-C Charging Port - shall be capable of being charged from a standard USB port - including a port on a computer

f. Power button functionality

g. Power on - turns the microphone on when microphone is off and button is pressed

h. Mute - mutes the microphone when pressed and released once microphone is turned on

i. Power Off - push and hold to turn power off

2. Additional Function (F) Button Features

a. SAFE Alert Functionality - Provides security alert when the two buttons on the sides of the microphone are pressed and held for more than two seconds

b. Recording Functionality - Provides simple logic signal when the REC button is pressed on the face of the microphone which activates terminals on the receiver

c. Intercom Call Button - Initiates a 2-way intercom call across the network

d. Confirm Room Response Button - allows the teacher to indicate to the front office that they have completed their assigned procedures for the classroom during a lockdown emergency.

3. External Inputs

a. Provide an input for an external microphone

b. Provide an input for a stereo auxiliary input (Mixed to Mono in microphone)

4. Microphone Element - The teacher microphone shall utilize a 10mm microphone element to insure optimum frequency response and maximum pickup of teacher’s voice.

5. Power 1 - LiON Long Life Battery (Systems using two batteries will not be considered)
    a. Battery style shall be common between handheld microphone and teacher transmitter. Systems that use different batteries in the handheld vs teacher microphone shall not be considered.
6. Provide remote volume control for the system from the teacher's transmitter
    a. Volume control via the wireless microphone system to allow the teachers to remotely adjust their own volume level.
    b. Volume control for the other channel from the teacher's microphone
    c. Volume control for the auxiliary inputs from the teacher's microphone
    d. Side Alert Buttons - Provide remote control functionality that allows for enabling additional multi-use functions from the teacher microphone.
    e. REC Button - Provide a button on the face of the microphone that can be used for multiple purposes.

T. STUDENT HANDHELD TRANSMITTER SHH-24
1. Operating frequency - 1.9 GHz - DECT
2. Integrated microphone
3. Internal charger circuit.
4. USB-C Charging Port - must be capable of being charged from a standard USB port - including a port on a computer
5. 1/8" (3.5mm) auxiliary input connection - Provide an input for a stereo auxiliary input (Mixed to Mono in microphone)
6. Power 1 - LiON Long Life Battery (Systems using two batteries will not be considered)
7. Battery style must be common between handheld microphone and teacher transmitter. Systems that use different batteries in the handheld vs teacher microphone will not be considered.
8. Operational Modes - the handheld microphone must be equipped with two operational modes
    a. Push-to-Talk Mode - the user simply depressed the power button to talk, and when released the microphone automatically turns off – this provides for a number of separate microphones to be used consecutively and greatly reduces the chance of channel interference
    b. Power-On Mode - The user depresses the power button, and slide is vertically into the on position -this holds the microphone in the on state for continuous operation
    c. Microphone Element - The Handheld microphone shall utilize a 10mm microphone element to insure optimum frequency response and maximum pickup of teacher's voice.

U. CLASSROOM SPEAKER PERFORMANCE SPECIFICATIONS
1. CS-12
    a. 7 inch Tile Cut in Speaker
    b. Spring loaded mounting tabs
    c. Vented Enclosure
    d. 8 Ohm Nominal, 50W Continuous Pink Noise
    e. Sensitivity - 88 dB (1W/1M)
    f. Frequency Response 70 Hz - 15 kHz (-10 dB) 100 Hz - 14 kHz +/-2 dB)
    g. Speaker back can meets UL2043 criteria for plenum installation.

h. Depth not to exceed 5.8 inches

V. CLASSROOM VISUAL DISPLAY FOR CLOCKS AND MESSAGES.

1. 21.5 inch Industrial Display
2. PoE Powered
3. Vesa mountable with included wall mount
4. Integrated and embedded Linux OS.
5. X64 architecture, quad core, 4GB RAM
6. 32GB Onboard storage
7. Resolution 1920X1080 32bit
8. Controllable by EPIC System.

W. HALLWAYS AND COMMON AREA VISUAL DISPLAY FOR CLOCKS AND MESSAGES

1. 21.5 inch Industrial Display
2. PoE Powered
3. Single or Double Mount Options, wall or ceiling.
4. Integrated and embedded Linux OS.
5. X64 architecture, quad core, 4GB RAM
6. 32GB Onboard storage
7. Resolution 1920X1080 32bit
8. Controllable by EPIC System.

X. CLASSROOM INTERCOM, EMERGENCY ALERT & A/V TOUCH PANEL CONTROL - AUDIO ENHANCEMENT - CAPACITIVE TOUCH CONTROL MODULE (ITC2-M)

1. For all locations where an MS-x00 Classroom Amplifier/Network Interface is specified.
2. Coordinate with electrical contractor to make sure a double gang electrical box is available - or use an acceptable double gang mounting ring
3. Provide a simple, standardized control interface for projectors, monitors, display devices, or other AV devices in a compact double-gang form factor. A CUSTOMIZABLE INTERFACE which will allow for a variety of configurations including full color graphical representations of equipment and buttons as well as multi-page capability.
4. Multiple School Based Configurations for Emergencies
5. SAFE Room lockdown, secure in place and reporting.
6. Package Type: Double-Gang Back Lit Capacitive Touch Screen
7. Dimensions: 4.5” (L) x 4.5” (W) x 1.25” (D)

Y. HDBASET HDMI EXTENDER WALL PLATE SPECIFICATIONS (OPTIONAL)

1. Supports HDMI 2.0, HDCP 2.2
2. HDMI Extender Distance: Up to 100m/300ft using category 6 or greater cable.
3. Provide USB connection from transmitter at teacher workstation to receiver for passing HID information to interactive technology. USB shall support USB 2.0 performance.
4. Provide an audio line output at the teachers work-station - audio line output shall provide all classroom program material and classroom microphone audio from the amplifier to allow connection of personal assistive listening devices.
5. Input/Output: HDMI Type A female connector on input plate and output receiver.
6. Support HDBaseT POH from transmitter and receiver.

7. Support for locally connecting a local control panel to the transmitter plate supplying both control and power to the system.
8. Video resolution up to 4K2K@30Hz 4:4:4/4K60 4:2:0
9. HDMI audio formats support PCM2.0/5.1/7.1CH, Dolby Digital/Plus/EX, Dolby True HD, DTS, DTS-EX, DTS-96/24, DTS High Res, DTS-HD Master Audio, DSD
10. Support audio extracting to analog output at receiver with 3.5mm audio output.
11. HDCP (High - bandwidth Digital Content Protection) Compliant
12. HDBaseT Class B Compliant
13. EDID (Extended Display Identification Data) Support
14. HDMI, USB and Audio Return shall all be transmitted over a single CAT 6 cable
15. ESD Protection of Human body model - ±8kV (Air-gap discharge) & ±4kV (Contact discharge).
16. Single Gang size, powered from receiver via POH.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The entire system shall be installed in a workmanlike manner, in accordance with approved manufacturers wiring diagrams and these specifications. The contractor shall furnish all conduits, cable tray, surface raceway, wiring, outlet boxes, junction boxes, cabinets etc. as well as all required miscellaneous materials and labor necessary for the complete installation of the cable support / pathway system.

B. Wiring may be opened wired in cable tray or "J" hooks above accessible suspended lay-in ceilings. Wiring in walls or exposed on walls shall be enclosed in EMT conduit. Cable shall be supported at a minimum of every 5 feet.

C. A nylon pull string shall be installed in each conduit / surface raceway run.

D. Any locations where flexible metal conduit has to be used, it shall terminate to a junction box on both ends and be securely anchored for proper support.

E. Conduit indications in the drawings are a minimum standard.

F. All equipment shall be mounted with sufficient clearance for observation, servicing, testing and accessible from either the floor or ladder. If any device is installed in a location that is deemed inaccessible by the Owner and or Architect / Engineer, it will be moved to an accessible location by the contractor at no additional cost to the Owner.

G. The contractor shall supply access panels where required and as defined by the Architect / Engineer. Contractor to notify the Architect / Engineer immediately if this issue arises during construction.

H. All penetration of floor slabs and firewalls shall be fire stopped in accordance with all Federal, State and local codes.

I. All wiring shall be color coded per National Electrical Code requirements and standards.

J. All conduit ends shall have plastic grommets to protect cable from damage due to sharp edges on the conduit.

K. Mounting heights and mounting requirements shall be as shown on the drawings.

L. All junction boxes shall be clearly marked and labeled for easy identification. Flexible connectors shall be used for all devices mounted in suspended lay-in ceiling panels. All conduits, outlet boxes, junction boxes and panels shall be securely installed and anchored with appropriate fittings and connectors to insure positive grounding throughout the entire system.

M. No wiring except that of this system shall be installed in this systems cable support / pathway system.

N. Wiring splices shall be made only in designated junction boxes and tagged on both sides of the junction. The junction shall be made on clearly labeled, insulated terminal strip. Transposing or changing the color-coding of the cable is not permitted. Wire nut connectors are not acceptable. System cable and the 120vac power cable shall be in separate conduits.

O. It shall be the responsibility of the contractor to wire and connect ancillary devices to this system as listed in this specification section.

P. Any circuits leaving the building to the outside shall be protected by the appropriate transient protection devices as required by the manufacturer to avoid damage to the system if transient surges are inducted on to these circuits (i.e., lighting strikes).

Q. Contractor to provide in-wall bracing support for all devices that are to be wall mounted to walls that are not masonry block walls.

R. All devices shall be protected throughout the entire project. All devices shall be kept free of construction dirt and debris during the entire project. The contractor shall be responsible for replacing at no additional cost to the Owner any devices that are deemed dirty or unsuitable for use by the Owner and or Architect / Engineer throughout the entire project.

S. All cabling and devices shall be labeled with type written labels. Device labels and cable labels shall match the labeling information that is documented on the as-built drawings. Contractor to coordinate labeling schemes and labeling requirements with A/E prior to commencing with final labeling. Labeling system shall be by Brady or Panduit.

3.2 INSTALLER QUALIFICATION

A. Installer shall have a BICSI RCDD (Registered Communication Distribution Designer) on staff.

B. Installer shall have an Avixa CTS (Certified Technology Specialist) on staff.

C. Installer shall be an Authorized Audio Enhancement reseller and be certified in EPIC System, level 1 and level 2.

D. Installer shall hold an appropriate State Contracting or Electrical License as required.

3.3 FIELD QUALITY CONTROL

A. The system shall be installed and fully tested as listed in these specifications. The system shall be demonstrated to perform all features and functions as listed in these specifications at a minimum.

3.4 TESTING

A. Reports of any field-testing during the system installation shall be forwarded to the Owner and Architect / Engineer for review and comment.

B. Each individual system operation on a circuit-by-circuit basis shall be tested for its complete operation. Any devices that are to be connected to the system shall be tested as specified. Device locations and address/ circuit numbers shall be documented on the as-built drawings as well as the wiring configuration of the device circuits. Device locations shall be field verified by the contractor and shall include any costs in the bid that is relating to all devices being connected to the system. The procedure for testing the entire system shall be set forth in these specifications and with the consent and approval of the Architect / Engineer, Owner and equipment manufacturer. Confirm testing requirements with the Owner and Architect / Engineer prior to commencing with system testing.

C. Perform the tests and adjustments necessary to assure the satisfactory quality and level of performance of the system under normal operating conditions.

D. Establish the normal settings for all controls and devices for all system operational and functional features and record the same for future reference. All levels shall be set and recorded in the as-built documentation for optimum system performance.

E. The installation technician from the installer / manufacturer shall perform all system tests as specified. Perform all tests in the presence of the Owner, Architect / Engineer and any

designated personnel as deemed necessary by the Owner or Architect / Engineer. This test shall be performed with the devices at their operational location and under normal operational conditions. Bench or default settings for devices are not acceptable. All test and test report costs shall be included in the contractors bid. A checkout report shall be generated by the installation technician and submitted to the Owner and Architect. The report shall include but not be limited to the following:

1. A complete list of all equipment installed with corresponding serial numbers.
2. Indication that all equipment is properly installed, functions and conforms to the specifications.
3. Serial numbers, locations by device and model number for each installed device.
4. Technicians name, specified certification credentials and date of system test.
5. Any additional information as deemed necessary by the Owner and or Architect / Engineer.

F. A substantial completion test shall be performed before the final test and acceptance of the system by the Owner and Architect / Engineer. At the time of the substantial completion system test, provide to the Owner or his representative an oral explanation of the operation and maintenance of the system. Before starting the tests and adjustments listed above, the contractor shall submit the following to the Owner and the Architect / Engineer for review during the substantial completion test:

1. Preliminary as-built wiring diagrams of the entire system.
2. Preliminary copy of the operation and maintenance manuals.
3. Preliminary copy of the system test report form.

G. If no system performance issues arise during the substantial completion test that need to be repaired by the installation contractor, this can be approved as the final system test by the Owner and or Architect / Engineer. If there are performance issues that arise that do need to be repaired, another complete and comprehensive system test shall be scheduled and performed to show that the necessary repairs have been properly addressed. These tests shall be performed at no cost to the Owner until a time that the system is shown to be in complete operating condition as approved by the Owner and Architect / Engineer.

H. A commissioning report of all the tested functionality of the system shall be provided by a certified L2 technician by the manufacture or by the manufacture themselves.

3.5 DOCUMENTATION AND TRAINING

A. After the final system test and the Owner and Architect / Engineer has accepted the system to be in the proper operating condition, the contractor shall compile and provide to the Owner 3 complete operation and maintenance manuals and 3 sets of as-built drawings on the completed system to include but not be limited to the following:

1. Operating and maintenance instruction sheets for each piece of equipment showing the proper operation and maintenance of the system component.
2. Individual factory issued operation and maintenance catalog brochures of all equipment and components that were installed as part of the system. Advertising brochures, submittal data sheets and operational materials shall also be included but shall not be used in lieu of the required technical manuals.
3. Complete as-built wiring diagrams and floor plan drawings of the complete system installation showing how the system was installed. These drawings shall include any devices that are connected to the system with their address / circuit number documented as well as the wiring configuration of all device circuits. The as-built drawings shall be an updated and revised copy of the submittal drawings showing all modifications made during the installation of the system. A copy of the as- built drawings in electronic format in AutoCAD Release 2014 or higher will be forwarded on to the Owner and Architect / Engineer for archiving in the operation and maintenance manuals.

4. A statement of guarantee including the date of the termination of the warranty as well as the phone number of the person to be called in the event of equipment failure.
5. A cover letter, for the above mentioned tests, certifying the entire system and its components, application and installation meets or exceeds the recommendations of the manufacturer, all applicable code requirements and test specifications.

B. The final and installed version of the system software shall be provided to the Owner on a via electronic means the operation and maintenance manuals. These manuals shall be used for final check out of the system.

END OF SECTION

SECTION 27 53 13 - GPS WIRELESS CLOCK SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the sections included under Division 01, General Requirements, are included as a part of this section as though bound herein.

B. Standards - Conform to the requirements of the following:

1. Federal Communications Commission FCC Part 90.35
2. Federal Communications Commission FCC Part 90.257 (b)

C. Licensing

1. The system must operate in accordance with a “Radio Station Authorization”, Form FCC 601–LM, granted by the Federal Communications Commission (FCC). License will be issued to and held by the Owner.

1.2 DESCRIPTION

A. Provide a wireless clock system that continually synchronizes clocks throughout the campus.

B. The system shall provide wireless time from a master time source. This time source shall be from the clock of a defined NTP server that the transmitter can access via the owner’s Ethernet. Hard wiring will not be required to the clocks installed for the system. Clocks shall automatically adjust for Daylight Saving Time in locations where DST is observed.

C. The system shall have an internal clock reference so that a failure to detect the master time source shall not result in the clocks failing to indicate time.

D. The system shall incorporate a “fail-safe” design so that failure of any component shall not cause failure of the system. Upon restoration of power or repair of failed component, the system shall resume normal operation without the need to reset the system or any component thereof.

1.3 WARRANTY

A. Provide a 5 year manufacturer’s warranty on all receivers, transmitters and clocks beginning from the date of final completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of design:

1. Primex Wireless

2.2 EQUIPMENT

A. General: The system shall include a wireless transmitter with Ethernet port for NTP time input, a surge suppressor/battery backup, and a mounting shelf. Unit shall obtain current time via NTP through the Ethernet port. The clock system shall transmit time continuously to all clocks in the system.

B. Transmitter: Unit shall obtain current time from NTP through the Ethernet port. The unit shall transmit time continuously to all clocks in the system. (XR01 IM, 3 req’d)

1. Transmission:

a. Frequency Range: 72.020 to 72.980 MHz, 74.610 to 74.790 MHz, 75.210 to 75.390 MHz, 75.440 to 75.600 MHz. Each range is reserved by the FCC for licensed fixed mobile broadcasts Transmission

b. Transmission Power: 1 watt (30dBm) maximum

c. Radio technology: Narrow band FM.
d. Number of channels: 74
e. Channel bandwidth: 20 kHz maximum.
f. Transition mode: One-way communication
g. Data rate: 2 KBps
h. Operating range: 32-degrees F to 158-degrees F)

2. Transmitter
   a. Transmitter output power: +26 to +30 dBm
   b. Frequency deviation: ± 4 kHz
   c. Transmitter power requirements: 120 VAC, 60 Hz
   d. Internal power requirements: 5 VDC
   e. Carrier frequency stability: ± 20 ppm
3. Transmitter shall have 74 selectable channels to assure interference-free reception.
4. Transmitter shall have the following switches:
   a. Time zone adjustment switches for all time zones in the world. Includes all US time zones: Eastern, Central, Mountain Pacific, Alaska, and Hawaii.
   b. Daylight Savings Time bypass switch.
   c. 12-hour or 24-hour display.
5. Transmitter housing shall be a black metal case.
6. Antenna shall be 46 inches high, commercial type, mounted on top center of the transmitter housing. Antenna gain shall be <2.2 dB. Antenna polarization shall be vertical.
7. Transmitter housing shall incorporate a display which shall include the following:
   a. Time readout
   b. AM and PM indicator if 12-hour time display is set.
   c. Day and date readout
   d. Time zone indicator including Standard or Daylight Savings Time.
   e. LED which shall flash red in event of reception problem
8. Internal Clock: Transmitter shall contain an internal clock such that failure to update time from source will not disable the operation of the clocks.

C. Power Supply:
   1. Input: 120 VAC, 50/60 Hz, 0.4 amp
   2. Output: 9 VDC, 1.5 amp

D. Surge Protector/Battery Backup (included)
   1. Input: 120-volt AC 60 Hz +/- 1 Hz
   2. Output: 120-volt AC, 500 VA, 300 watts
   3. Surge Energy Rating: 365 joules.

E. Clocks (traditional analog): Clocks 12-1/2 inch or 16 inch diameter as selected. Clocks shall be wall mounted with polycarbonate frame and lens; Face shall be white. Hour and minute hands shall be black with red sweep second hand. Color and finish as selected by the Architect.
   1. 12-1/2 inch and 16 inch clocks shall be battery operated and have a 5 year battery life.

2. Clock shall be capable of automatically adjusting for Daylight Saving Time. An ON/OFF switch located on the transmitter shall disable this function if desired.
3. Time shall be automatically updated from the transmitter 6 times per day.
4. Clocks shall remember time during changing of batteries
5. Analog clock receivers shall be as follows:
    a. Receiver sensitivity: > -110 dBm
    b. Receiver power: Dual lithium battery pack, supplied by manufacturer.
    c. Antenna type: Internal
    d. Antenna gain: -7 dBd
6. If transmitter stops transmitting valid time signals due to power failure, the clocks will continue to function as accurate quartz clocks until a valid time signal is decoded.

F. Wire guards: Provide wire guards for clocks located in Gymnasium or other areas as designated by the owner.
1. A wire guard 14 by 14 inches shall be provided for nominal 12-1/2 inch diameter analog clocks.
2. A wire guard 18 by 18 inches shall be provided for nominal 16 inch diameter analog clocks

PART 3 - EXECUTION

3.1 INSTALLATION

A. General
1. Install all equipment in accordance with manufacturer’s instructions.
2. Install equipment ensuring appropriate ventilation to meet manufacturer’s requirements.
3. Securely mount equipment plumb and square in place.

B. Coordination:
1. Coordinate installation with all existing conditions.
2. System is an extension of an existing system on site. Verify frequencies of new equipment do not interfere with the existing system.

3.2 FIELD QUALITY CONTROL

A. Field Testing:
1. Check the quality of signal and adjust antenna location as required.

B. Testing and Demonstration:
1. Upon completion of the system installation notify the Owner that the system is ready for testing and demonstration.
    a. At this time, provide all system documentation; also, all Component and System warranties are to be presented to the Owner for prior evaluation.
    b. The Owner, at his option, may select a specific time and date suitable to all parties and have a representative in attendance during the final testing and demonstration.
    c. Conduct all tests and demonstrations in the presence of the Owner.
    d. Demonstrate all system function to perform as specified.

3.3 DEMONSTRATION

A. Provide two 4 hour on-site training sessions and instruction to the Owner’s designated representatives in the set-up, operation and use of all system equipment.

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1. All instruction and training is to be given after completion of the installation and testing.
2. Arrange instruction and training sessions at the Owner's convenience.
3. The manufacturer shall provide a comprehensive training outline for the Owner & Engineer to review within 90 days of substantial completion.
4. Provide operating and users' guides to the Owner's representatives at training sessions.
5. Training sessions are to be video recorded with master and 2 copies (MPEG 4 format) turned over to owner at the completion of the training session.

END OF SECTION

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SECTION 27 70 00 - CLASSROOM SOUNDFIELD DISTRIBUTION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

B. This section is a Division 16 Basic Materials and Methods section and is part of each Division 16 section making reference to electrical raceways, boxes, fittings, data distribution, etc., included herein.

1.2 DESCRIPTION OF WORK:

A. Provide a combined educational presentation system, consisting of a classroom sound amplification system (CSAS), and supports future implementation of a teacher personal alert security system with all necessary materials and labor to fulfill the requirements and the intent of the specifications to form an integrated classroom technology and security system. Each system shown in the plans, in classrooms or any teaching station shown, is a complete distinct and individual system as specified herein.

B. Equipment shall be furnished and installed as specified unless written approval for substitutions is obtained from the engineer. Catalog sheets of all proposed equipment shall be provided with the proposal.

C. All electronic equipment shall be new and of current model. Systems shall be guaranteed for a period of 1 year from the date of completion against defective materials, inferior workmanship, or improper installation adjustment. Guarantee shall cover all parts and labor.

D. The contractor shall furnish the owner with 3 complete sets of service and operating literature.

E. All equipment shall be installed by a communications contractor with at least 5 years' experience installing similar systems. The contractor shall be the factory authorized distributor for the geographical area and shall maintain complete installation and service facilities.

F. All work shall be done by expert technicians qualified in the field with knowledge of systems and detailed requirements for fine-tuned performance. Workmanship shall comply with standard professional broadcast practice concerning grounding, shielding, cable dressing, cable termination and equipment mounting. All mounting holes shall be utilized for any equipment.

G. No amplifier shall be connected to a load that exceeds 90% of the rated output.

H. Systems shall function without audible distortion, hum, buzz, or rattle under normal operating conditions. Equipment shall be installed plumb and square.

I. Cables shall be marked with commercial wire markers and shall be designated with the architectural room number or description of the area served by that circuit.

J. All equipment shall be installed as shown on the drawings and in strict accordance with the specifications. Any errors, conflicts, or omissions discovered in the specifications or the drawings shall be submitted in writing to the engineer for clarification. Installation shall not proceed until questions have been resolved.

1.3 QUALIFICATIONS:

A. Any system and/or equipment proposed as an equal to that specified must be proven to conform to the standards established herein. The contractor must obtain the architect's or engineer's approval in writing, prior to bidding equipment other than that specified. The manufacturer's name, model numbers and 3 copies of shop/working drawings complete with catalog sheets, technical and installation data shall be submitted for approval.

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1.4 SUBMITTALS:

A. Product Data:

1. Submit manufacturer's data sheet including specifications, installation instructions, and general recommendations for each piece of equipment specified.

B. Shop Drawings:

1. Submit dimensioned drawings and wiring layout for any changes in wiring from the layout in the drawings.

PART 2 - PRODUCTS

2.1 GENERAL

A. The system shall provide sound enhancement to amplify a teacher's voice to overcome the deleterious effects of background noise, reduce teacher fatigue and assure speech clarity of class presentation and participation. The system shall also provide an inconspicuous personal alert for the teacher, for future implementation, enabling her to notify a central location during an emergency situation. No component in the audio system shall have to be changed out to implement the personal alert at a future date. Provide an infrared wireless system with no channel restrictions, no interference, a room contained signal and inputs for 2 microphones, T.V./DVD, CD and computer and output for personal FM radio systems. Provide the ability to power up to eight speakers. System includes speakers, cables, microphones, transmitters, receivers, nickel metal hydride rechargeable batteries, chargers, etc., as required for a complete operational system.

B. The system shall be the Sentinel System by Audio Enhancement. Substitutions are not permitted.

2.2 CLASSROOM SOUND AMPLIFICATION SYSTEM (CSAS) EQUIPMENT:

A. AMPLIFIER - Audio Enhancement CA-50A Amplifier:

1. The amplifier shall be used to power the speakers contained within the classroom. It will provide the ability to connect to the dedicated self-contained infrared receiver in the ceiling via a CAT-5 cable. The amplifier shall have the ability to facilitate a recording output for use with interactive technologies. The amplifier shall be of a low-profile design, designed to be mounted vertically so as to not take up any horizontal shelf space. The width when mounted vertical shall not exceed 1 inch.
2. The Amplifier shall meet the following specification:
    a. Audio Power: 32 Watts RMS
    b. THD < 1% 50 Hz to 15 kHz
    c. Frequency Response: 50 Hz to 15 kHz +/- dB
    d. Power Requirements: 24 VDC, 2 Amps. Power Supply shall be included e. The amplifier shall have the following controls:
    e. Auxiliary Input Volume Controls - 3 Front Panel Controls
    f. Assistive Listening/Line Output - 1 Front Panel Control
    g. Power On/Off - Front Panel Control
    h. 3-Band Equalizer - Side Panel Controls - Controls must be rotary shaft style controls.
    i. All volume controls for both the teacher and student pass around microphone shall be done remotely through the teacher microphone only. Systems that have level controls for the teacher or student microphones on the amplifier or in any other location other than on the teacher microphone will not be considered.
3. The amplifier shall have the following connections:
    a. Assistive Listening/Line Output - Front Panel

b. Line/ALD Output - Front Panel
c. 2 Speaker Connections - Rear Panel
d. 3.5 mm Line Inputs - Rear Panel
e. 1 - 3.5 mm Line Input - Front Panel
f. Connection Adapter with Modular 8P8C Jack for connection to Ceiling Infrared Sensor/Receiver
g. Coaxial 24 VDC Power Connection

B. INTEGRATED INFRARED SENSOR / RECEIVER – IR-SATELLITE:
1. The Integrated Infrared Sensor/Receiver will be an independent system, with all necessary electronics to support the infrared receiving functionality mounted in the ceiling. The sensor/receiver will be connected to the amplifier through a universal twisted pair cable, using balanced audio connections. Power for the infrared sensor receiver will be provided through the same cable as the balanced audio connections.
2. The sensor receiver will provide the following functionality. These features must be included on board the sensor/receiver, and not require any external support to perform these functions.
a. Dual Channel Infrared reception
b. Auxiliary Input.
c. Remote control of both infrared channels, and the auxiliary input from the teacher microphone.
d. Public address system mute terminals – This is a contact closure connection when closed, it mutes the audio output from the sensor/receiver.
e. Advanced Feedback Blocker
i. The system shall have the ability to actively control feedback. This shall be done via an analog circuit that provides up to five active filters to control specific frequencies,
ii. The Feedback Blocker shall also have the ability to lower the overall of the system by up to 6dB, during a user error situation where the overall system gain is manually turned up too high.
iii. The Feedback Blocker system shall automatically remove the filtering upon resolution of the user-initiated error condition.
iv. The Feedback Blocker shall be of an analog design - in order to avoid the detrimental effects of digital sampling, only analog systems shall be considered in order to implement this feature.
f. Audio Output
i. The system shall have the ability to provide both 3 independent audio signals (Ch 1, Ch 2, and Aux) or with the change of a DIP switch, provide a mixed signal.
ii. The system shall provide an audible tone when the remote volume control on the teacher microphone is used. It will also provide a low & high output level, and an on/off selection via a DIP switch setting.
iii. The system shall have the capability of attenuating its output level by -10 dB with a DIP switch setting.
g. Emergency Alert Contacts
i. The system shall provide a trigger signal when the teacher presses and holds a button on her transmitter for more than 2 seconds.
ii. The system shall be capable of providing a visual indication of 3 red LED’s when

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the teacher initiates a trigger signal.

iii. The system shall also be capable of receiving a trigger acknowledgement signal back from an external source and altering the visual indicator from 3 red LED's to 2 Green and 1 red LED.

h. Control System Integration

i. The system shall have on board the capability of being controlled via RS-232 protocol.

ii. The system shall also have the capability of broadcasting RS-232 commands when the teacher presses the up/down volume controls on their microphone.

i. Power Requirements: 24 VDC, Power Supplied from the amplifier.

j. Receiving Frequencies: 2 selectable frequencies: 2.3 MHz and 2.8 MHz. k. Receiver Type: Tuned Radio Frequency (TRF)

l. Signal-to-noise: >80 dB

m. External Sensor(s}

i. The system must be capable of operating in a standard classroom without the addition of any external sensors.

ii. For larger spaces, the system must be capable of support up to 4 additional infrared sensors.

n. Mounting Bracket as required

o. Controls: System must have available the following controls

i. Channel 1 Volume Control - Fully controllable from the teacher microphone remotely through the Infrared system

ii. Channel 2 Volume Control - Fully controllable from the teacher microphone remotely through the Infrared system

iii. Auxiliary Input Volume Control - Fully controllable from the teacher microphone remotely through the Infrared system

C. 4-Channel Body Pack Transmitter (Audio Enhancement Infrared Enhanced Teardrop Microphone): Provide a 4-channel body pack transmitter with performance as follows:

1. Sub-carrier frequencies: 4 selectable frequencies from 2.00 MHz to 4.00 MHz
2. Audio distortion: <1.0% (±40 kHz deviation @ 1 kHz)
3. Integrated microphone.
4. Internal charger circuit.
5. Built-in infrared emitters.
6. Power button functionality
   a. Power on - turns the microphone on when microphone is off, and button is pressed.
   b. Mute - mutes the microphone when pressed and released once microphone is turned on.
   c. Power Off - push and hold to turn power off.
7. Function (F) Button Features
   a. F1 Functionality - Provides simple logic signal on F1 terminals on the IR- Satellite senor/receiver.
   b. F2 Functionality - Provides security alert when button is pressed and held for more than 2 seconds.

8. External Inputs
    a. Provide an input for an external microphone.
    b. Provide an input for a stereo auxiliary input (mixed to mono in microphone)
9. Microphone Element - The teacher microphone shall utilize a 10 mm microphone element to insure optimum frequency response and maximum pickup of teacher's voice.
10. Power 1 - "AA" NiMH Batteries (Systems using 2 batteries will not be considered),
11. Provide remote volume control for the system from the teacher's transmitter.
    a. Volume control via the infrared wireless microphone system to allow the teachers to remotely adjust their own volume level.
    b. Volume control for the other channel from the teacher's microphone
    c. Volume control for the auxiliary inputs.
    d. 'F' (Function) Button - Provide remote control functionality that allows for enabling additional multi-use functions from the teacher microphone.
12. Smart Sensor Charging Circuit
    a. Charging circuitry in microphone must have the ability to sense what type of battery has been placed in the microphone. The charging circuitry must also carefully manage the charge and discharge cycles of the batteries to maximize battery life.
    b. A system that simply senses voltage present on a 3rd contract is not acceptable; the charging circuitry must be able to distinguish between NiMH, NiCD and Alkaline batteries.

D. 4-Channel handheld transmitter (Audio Enhancement Infrared Handheld Microphone):
1. Sub-carrier frequencies: 4 selectable frequencies from 2.00 MHz to 4.00 MHz
2. Integrated microphone
3. Internal charger unit
4. Power 1 - "AA" NiMH Batteries (Systems using 2 batteries will not be considered)
5. 1/8 inch auxiliary input connection - Provide an input for a stereo auxiliary input (mixed to mono in microphone).
6. Operational Modes - the handheld microphone must be equipped with two operational modes.
    a. Push-to-Talk Mode - the user simply depresses the power button to talk, and when released the microphone automatically turns off - this provides for a number of separate microphones to be used consecutively and greatly reduces the chance of channel interference.
    b. Power-On Mode - The user depresses the power button and slide vertically into the on position - this holds the microphone in the on state for continuous operation.
7. Microphone Element - The Handheld microphone shall utilize a 10mm microphone element to insure optimum frequency response and maximum pickup of teacher's voice.
8. Smart Sensor Charging Circuit
    a. Charging circuitry in microphone must have the ability to sense what type of battery has been placed in the microphone. The charging circuitry must also carefully manage the charge and discharge cycles of the batteries to maximize battery life.
    b. A system that simply senses voltage present on a 3rd contract is not acceptable; the charging circuitry must be able to distinguish between NiMH, NiCD and Alkaline batteries.

E. Additional External Dome Sensor - If Required (Audio Enhancement Infrared Dome Sensor):
   1. Power: Powered by receiver.
   2. 360-Degree reception angle, ceiling mounted dome sensor.
   3. Cable: Minimum 32.8 feet, Co-Ax Cable (provide plenum rated only where required by code)
   4. Mounting: Metal bracket
   5. Internal construction of diodes in 360-dgree sensor shall be lensed to provide superior infrared reception. Unsensed diodes shall not be considered.

F. Loudspeaker:
   1. Provide complete distributed ceiling mounted speaker system (metal back box, speaker, grill, etc.). Audio Enhancement Model CS-09, number as required (minimum 4, no cluster)
   2. With performance and safety features as follows:
      a. Frequency Range: 70 Hz to 15 kHz (-10 dB)
      b. Frequency Resp: 100 Hz to 14 kHz +/- 3 dB
      c. Power Handling: 50 Watts continuous
      d. Driver type: 4 inch Cone
      e. System type: Tuned and vented.
      f. Sensitivity: 88 dB 1 Watt/1 Meter
      g. Impedance: 8 Ohms nominal
      h. Mounting: Integrated C-clamp
      i. Plenum rating: Speaker back can meet UL2043 criteria for plenum installation.
      j. Terminals: All metal spring terminals
      k. Dimensions: Depth 5.8 inch
      l. Grill Diameter: 8.5 inch
      m. Mounting hole: 7.0 inch
      n. Weight: 3.0 lbs.

PART 3 - EXECUTION

3.1 INSTALLATION OF SOUND SYSTEMS:

A. Install each system shown as indicated, in accordance with equipment manufacturer's instructions, and with recognized industry practices, to ensure that system equipment complies with requirements. Comply with requirements of NEC and applicable portions of NECA's "Standard of Installation" practices.

B. Provide each individual CSAS with a receiver/amplifier, teacher microphone with transmitter, handheld microphone, external sensors as required, speakers as required (minimum 4) and all cable necessary. Before rough-in, test each application for the number and location of sensors and speakers required. Install sensors as required for complete coverage in all parts of the space. Coordinate the number of speakers required with the reflected ceiling needs. Provide a black box for each speaker and verify all support requirements. Provide audio wiring from the receiver/amplifier to the video system controller in the room.

C. Coordinate with other electrical work, including cable/wire, raceways, electrical boxes and fittings, as appropriate to interface installation with other systems work.

D. Provide each video system with all equipment specified and cables shown for a complete system.

E. Provide stainless steel cover plates on all devices and boxes serving the Audio/Visual system to match other electrical system devices.

3.2 FIELD QUALITY CONTROL:

A. Measure and record sound power levels at designated locations.

3.3 EQUIPMENT CHECKOUT:

A. Provide equipment checkout by a factory trained and authorized technician before energizing circuits. Make final connections under his direction.

3.4 TESTING:

A. Upon completion of installation of the system and after electrical circuitry has been energized, demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed retesting.

3.5 WARRANTY:

A. The contractor shall warrant the equipment to be new and free from defects in material and workmanship, and will, within one year from date of installation, repair or replace any equipment found to be defective. This warranty shall not apply to any equipment which has been subject to misuse, abuse, negligence, accident, or unauthorized modification.

3.6 TRAINING:

A. Provide a minimum of four 10 hours (minimum) training on the operation and maintenance of the audio/visual presentation system, at job site. Provide programming and software training as required to allow the district to do any programming that the supplier is allowed to do during commissioning, testing, service and field additions or deletions to the system. Illustrate utilization of all components, DVD, VCR, projector, etc. and the interaction of the complete system. Conduct separate 2-hour sessions in each “pod” and each grade level. Provide this training at no cost to the Owner, including transportation, lodging, meals and training manuals.

END OF SECTION

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SECTION 28 13 10 - ACCESS CONTROL SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 1, General Requirements, are included as a part of this Section as though bound herein.

1.2 PERFORMANCE REQUIREMENTS

A. Purpose:

1. Provide an electronic access control system for all new construction and renovation projects.
2. Electronic access control shall be located at designated perimeter doors leading to each of the program areas with electric re-strike rim exit device, controlled by the district's existing access control system.
3. The electronic access control system shall include all necessary components, wiring for power and control to sensors, card access controls, door hardware devices, uninterruptible power supply system (UPS) and capable of interfacing with existing Avigilon Unity Access Control software for a complete operable and fully integrated system that is capable of control through the district's existing access control system.
4. Raceway system shall consist of dedicated conduits, J-hooks, sleeves, boxes and wiring for an access control system.
5. The electronic access control system shall be independent from Intrusion Detection System and shall be a network-based control system, connected to the existing MCSD Avigilon Unity Access Control Manager.

B. The System shall include but not be limited to:

1. Main Cabinet shall be surface mounted steel construction, Avigilon Panel Model # AC-LSP-16DR-MER-LCK installed on a plywood backboard. Main cabinet shall be installed in the MDF Room, including all required power supplies, batteries, integral charger, and the software for a complete fully operational system.
    a. Backboard: Plywood, 1/2 inch thick, AC Grade, covered with two coats of UL Classified, fire retardant intumescent paint, light gray color, painted front, rear, and all four sides.
    b. Backboard shall be clearly labeled with the name of the backboard manufacturer, UL classification of the Fire-Retardant Coating with the NFPA 255 Coating Flame Index and the APA Grade of the plywood. Backboard shall be securely fastened to the wall in order to support any and all attached equipment.
2. Surge suppression for the 120 VAC power supply.
3. Card readers.
4. The distribution cabinet must be within 300 feet of the controlled devices.
5. Raceway shall not exceed 400 feet without a pull box.
6. Grounding.
7. Dedicated and not shared raceways, fittings, wire, and wire fittings.
8. A 2-inch raceway from the main cabinet to the next building and floor distribution cabinet.
9. Wire and cable labeling.
10. Programming Software that can interface with existing Avigilon system.

11. Electrical power is required to comply with all functions and operations required for the system.

C. Access Card Locations: Provide a card reader/controlled device at the following locations:

1. All designated access control doors are at the discretion of MCSD Safety and Security department and/or Educational Technology department.

1.3 QUALITY ASSURANCE

A. Installer Qualifications:

1. The Contractor shall use personnel who are manufacturer-certified, thoroughly trained and experienced with the specified requirements and methods needed for the proper performance of the work.

B. Manufacturer Qualifications:

1. Manufacturer shall have completed a minimum of five projects of equal scope to systems described herein and shall have been in the business of supplying and installing specified type of systems for a minimum of five years.

C. Fabricator Qualifications Mockups:

1. Fabricator shall have completed a minimum of five projects of equal scope to systems described herein and shall have been in the business of supplying and installing specified type of systems for a minimum of five years.

1.4 SUBMITTALS

A. Shop Drawings:

1. Shop Drawings shall be prepared in latest version of AutoCAD 2006 or later format with electronic copies submitted along with full sized Shop Drawings.
2. Shop Drawings shall indicate typical wire connections and cable types, keypad locations, and all main and remote panels. Provide wiring schematics including point-to-point, terminal strips, connections to batteries, and power supplies, including the estimated anticipated wiring lengths required for all connection points (i.e., zone and system communications bus runs) within the system. Indicate interfaces to equipment furnished by others.
3. Submit dimensioned Shop Drawings indicating mechanical layout of all card access equipment, including cabinets and interconnecting conduit for the main panel, typical remote panel, keypad, and indicator locations, identifying all parts by manufacturer and part number.
4. Shop Drawings shall be accompanied by engineering documentation including:
    a. Floor Plans indicating all components, raceways, and terminal boxes and cabling.
    b. Riser diagram indicating all connections in a manner following the floor plan layout.
    c. Cabling diagram indicating the Contractor’s designed routing and number of cables in specific raceways or conduits, from the main panel connecting to other sub-panels, modules, or devices. Diagram shall include length, in wire feet, and capacitance calculation charts for all cables.

B. Warranty Requirements:

1. Contractor shall warrant that all materials furnished shall be free from defects of material for a period of three years excluding specific items of work that require a warranty of a greater period that may be set forth in this Specification. Contractor shall warrant that workmanship for a period of three years from date of Final Completion, excluding specific items of work that require a warranty of a greater period that may be set forth in this Specification. Immediately upon receipt of written notice from the Owner, the Contractor shall repair or replace at no expense to the Owner, any defective material or work that may

be discovered before final acceptance of work or within the warranty period; any material or work damaged thereby; and adjacent material or work that may be displaced in repair or replacement. Examination of or failure to examine work by the Owner shall not relieve Contractor from these obligations.

PART 2 - PRODUCTS

2.1 MATERIALS, PRODUCTS, EQUIPMENT, MANUFACTURED UNITS

A. Raceways

1. General:
    a. Provide raceways (conduits, wireways, pull boxes, J-hooks, outlet boxes, etc.) in compliance with the requirements of the card access manufacturer, Section Conduit for Electrical Systems, and Section Outlet Boxes.
    b. Access Control System cabling and wiring shall not be in any shared raceway, conduit, J-Hook, or box with any other high or low voltage system.
2. Conduit:
    a. Provide conduit sized and based on fill in accordance with the NEC. Minimum size of conduit is to be 1 inch.
    b. Provide pull cords in all raceway installed without cable.
3. J-Hooks:
    a. Provide J-hooks in accordance with the NEC, EIA/TIA requirements for structured cabling systems. All cable supports shall be UL listed.
4. Boxes:
    a. Provide boxes sized as required by the system manufacturer and the NEC for cables and/or devices installed.

B. Conduit and Boxes

1. Provide and install the building and floor distribution cabinets for each building according to the following criteria:
    a. There must be one of these main cabinets within 300 feet of a door access reader.
    b. Each cabinet shall feed a minimum of eight controlled devices (access readers) and the cabinet can be located on any floor in an MDF or IDF room. It does not have to be located on the same floor as the controlled devices.
    c. The main cabinet can serve as the distribution cabinet for its area of eight door access readers.
    d. Minimum conduit size shall be 1 inch. No conduit shall be installed more than 150 feet without a pull box.
2. Provide 1-inch conduits if needed from the distribution cabinets and distribute to feed the junction and mounting boxes for each device.
    a. If a separate 120V feed is needed at any device, a separate conduit will be needed.
    b. Each separate 1-inch feed will supply no more than one Controlled Device/Card Reader Feed locations however if multiple devices are being installed in the same area, conduit sizes will need to be increased.
3. Provide and extend conduit to feed 2” x 4” x 2-1/8” flush mounted boxes with single gang mud ring and weatherproof covers; mounted with the opening vertical, at all designated card reader locations.
    a. Locate to the strike side of single doors, and as designated for double doors, and gates.
    b. Center 42 inches above finished floor/grade.

c. Exact location to be determined during plan review.

4. Provide a 2-inch x 4-inch x 2 1/8-inch card access feed junction box with cover at the interior side of all designated card access door locations.
   a. If the area location has removable ceiling tiles, the box shall be located above the tile.
   b. If the location has a structure of fixed ceiling material, then flush mount the box with a square to round mud ring and cover.
   c. Both boxes from a) and b) above shall be connected. Also, if door is a double door an additional single gang box will be installed, connected, and centered on the top of the door frame.
5. Provide a 1-inch conduit from the AMAG control box to the closet network switch if conduit is determined to be needed.
6. Cable:
   a. Provide at each card reader location, a single home run cable to the locations to be identified in the drawings. The cable for the Access Control System shall be Belden # 658AFS or manufacturer recommended equivalent with yellow jacket.
   b. Card Access system cables installed in interior, exterior and/or underground raceways shall comply with the applicable section of the NEC.
7. Power Feeds:
   a. Provide a dedicated 120v 20a circuit to each Access Control Panel, with each panel hard wired to the circuit.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Training of the School’s administrative and maintenance personnel is required in cooperation with the District’s Representative.
   1. Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections, and to assist in field testing.
   2. Report results in writing.

B. Startup Service:
   1. Engage a factory-authorized service representative to perform startup service in accordance with the manufacturer’s requirements.
      a. Complete installation and startup check according to manufacturer's written instructions.
      b. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
      c. Report results in writing.

C. Adjusting:
   1. When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to site during other-than-normal occupancy hours for this purpose. These visits are not considered as “warranty calls.”

3.2 ERECTION TOLERANCES

A. Install system in accordance with NECA "Standard of Installation" and Divisions 26, 27, and 28.

B. Permanently label all conduits as to plan room number destination, at all terminal cabinets.

C. Label all card readers with CR# as listed on job plans.

D. Label all access control wiring on each end with device number (i.e. CR#, Door #, REX #).

E. Install 200 lb. strength pull string throughout the conduit system.

F. The Access Control System shall be independent and shall not interconnect with or be used by any other system.

G. Mount all junction boxes located above the ceiling with the opening facing down unless mounted to the wall above the ceiling, and with a reasonable immediate access pathway provided.

1. Note: The requiring of removing of a light fixture or other similar ceiling equipment is not a reasonable access pathway.

H. All conduit runs shall be as direct as possible in order to save on wiring costs and to reduce poor performance due to cable loss.

I. Refer to Section Door Hardware for Card Access Door preparation.

J. The Contractor shall be advised that the circuit routing for the card access system may not be shown on the project drawings and that he is responsible to install all raceways, wiring and cabling for a complete and fully functional system.

K. General:

1. The Contractor shall provide and install the card access system (including raceways, pull and back boxes, and wire) in accordance with the Access Control System manufacturer's requirements.
2. The Contractor shall size and route raceways to accommodate the proper installation of the system cabling. T-tapped cabling is not acceptable.
3. Where raceway and/or conduit is not accessible after completion of the project, conduit shall be routed from device to device or fire rated access panels shall be installed to provide access to junction and pull boxes.
4. Device to device wiring is only to be acceptable where the wiring scheme of the system, as recommended by the manufacturer, requires cable to pass from device to device.
5. Termination of devices is to be in accordance with manufacturer's requirements.
6. Install Access Control System wiring with at least 12 inches of separation from line voltage power wiring on parallel runs. Wiring crossing power circuits shall be at right angles. For metal enclosed electric light or power or Class 1 circuits, separation may be reduced as described in the National Electrical Code. Increase separation if so required to comply with EIA/TIA referenced standards.
7. Each Access Control System outlet shall have splice-free cables homerun to the respective control panel in the associated Main/Intermediate Distribution Frame (MDF/IDF) at the communication equipment room (CER), communication closet (CC), or communication panel (CP) as indicated on the drawings. Each cable shall be tagged at each end.

3.3 DEMONSTRATION

A. Training of the School's Administrative and Maintenance Personnel is required in cooperation with the District's Representative:

B. Engage a factory-authorized service representative to train school administrative and maintenance personnel to adjust, operate, and maintain Card Access System. Refer to Division 1 Section Closeout Procedures for information regarding Demonstration and Training.

END OF SECTION

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SECTION 28 16 00 - INTRUSION DETECTION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the sections included under Division 1, General Requirements, are included as a part of this section as though bound herein.

1.2 GENERAL

A. The work described herein and, on the drawings, consists of all labor, materials, equipment, and services necessary and required to provide and test an Intrusion Detection System. Any material not specifically mentioned in this specification or not shown on the drawings but required for proper performance and operation shall be provided.

B. The drawings and specifications herein comply to the best of the Engineer's knowledge with all applicable codes at the time of design. However, it is this Contractor's responsibility to coordinate/verify (prior to bid) the requirements of the Authority Having Jurisdiction over this project and bring any discrepancies to the Engineer's attention at least 7 days prior to bid. No changes in contract cost will be acceptable, after the bid, for work and/or equipment required to comply with the Authority Having Jurisdiction.

1.3 DESCRIPTION OF SYSTEM

A. The Contractor shall furnish and install a complete and operating Intrusion Detection System. The system shall include but not be limited to:

1. Door Contacts
2. Motion Detectors
3. Acoustic Glass break Sensors
4. LCD Keypads
5. I/O Modules
6. Auto Dialer
7. Connection to Telephone System
8. Programming
9. Control Panels
10. Power Supplies
11. Battery Backup
12. Raceway/Outlet System, Wire, Cable, Etc., complete with all basic materials
13. Wire and cable Labeling
14. Terminal Blocks
15. Terminal Cabinets
16. Terminations
17. Grounding
18. Surge Suppression
19. Firestopping
20. Sensors
21. Programming

B. The Intrusion Detection System is to include all equipment, materials, and labor required to provide, install, and test a complete system as described herein.

C. Furnish and install a complete solid-state microprocessor-based security system. Each control panel shall be addressable and support up to 192 addressable devices. Activation shall cause a digital dialer to send in an alarm to the central monitoring station. The input power shall be 120 volts, AC. The control panel shall be supervised on the input power line with automatic switch over to battery backup. Provide battery backup sized for minimum 12 hours of continuous operation. Provide unit that will monitor input power and send "loss of AC power alarm" to central station after time delay. Panel shall be capable of remote programming (Upload and Download).

D. At least one keypad shall be provided for each panel whether shown on the drawings or not.

E. End of the line resistors (EL) shall be located in the control panel. All zone loops will be equipped with an EL. All field devices shall be home run to the control panel(s).

F. Surge suppression required. This Contractor shall provide surge suppression in conformance with Section Surge Suppression Equipment of the specification.

G. All equipment will become the property of the Owner.

H. The system supplier shall provide, at no cost to the Owner, a central station monitoring service and be available 24 hours per day and 365 days per year until the date of Final Completion at which time the Owner will take over monitoring of the system.

I. The system shall be wired so that after system is turned "on," exit from the building and entry to the building can be done through designated doors. There shall be a warning tone generated on the keypad during in/out time delay. The system shall have adjustable in/out time delay from 5 to 45 seconds.

J. Provide system complete with minimum 100 event memory logger.

K. Wiring/conduit connections/routing, etc. is not shown on drawings. Provide and install all wire, conduit, boxes, electrical basic materials, etc., as required for a complete operating system.

L. System cables to be installed in conduit.

M. System devices to be individually annunciated at system control panel.

1.4 STANDARDS, CODES, REFERENCES AND REGULATORY REQUIREMENTS

A. Reference Section Reference Standards and Regulatory Requirements

B. The equipment and installation shall comply with the current or applicable provisions of the following Standards:

1. All requirements of EIA/TIA.
2. All requirements to Federal Communications Commission.
3. National Fire Protection Association Standards:
4. NFPA 70 - National Electrical Code
5. NFPA 72 - National Fire Alarm Code
6. NFPA 101 - Life Safety Code
7. UL 13 - Power Limited Circuit Cables
8. UL 444 - Communications Cables
9. UL 1449 3rd Edition Standard for Safety for Surge Protective Devices
10. UL Standard 681, latest edition - Burglar Alarm Systems, Installations, Classification and Certification.
11. UL Standard 609, latest edition - Burglar Alarm Units and Systems, Local

C. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

D. Surge Suppression:

1. Equipment Certification: When available by any one manufacturer, all surge suppression equipment shall be listed by Underwriters' Laboratories, shall bear the UL seal, and be marked in accordance with referenced standard. Such surge suppression equipment shall be UL listed and labeled for intended use.

E. Comply with all standards and guides listed under "References" above.

1.5 RELATED SECTIONS/DIVISIONS/DOCUMENTS

A. All applicable sections of Division 00 and Division 01.

B. All applicable sections of Division 26

C. Section Surge Suppression (120V AC to 480V AC).

1.6 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum 10 years' experience and with service facilities within 50 miles of Project.

B. Supplier: Authorized distributor of control equipment manufacturer.

C. Installer: The intrusion detection system installer shall be an authorized dealer of the equipment manufacturer. Installer shall carry spare parts and a service organization to provide emergency service. Service and installation modification capability shall be available locally. At the request of the Design Professional, installer shall provide proof that:

1. Contractor is an authorized dealer of the equipment manufacturer.
2. Contractor has installed at least four systems within the last year and they are working satisfactorily.
3. Contractor has a service organization to provide emergency service.

1.7 SUBMITTALS

A. Submit in accordance with Sections Common Work Results and Submittals.

B. In addition to requirements of Common Work Results and Submittals, the Contractor shall submit:

1. Shop Drawings:
   a. Indicate system wiring diagram showing each device and wiring connection required.
   b. Submit riser diagram and layout shop drawing with terminal-to-terminal wiring diagrams of all units.
   c. 1/8 inch plans of all buildings showing each device and circuitry.
   d. Site plan showing distribution between buildings.
2. Submit Product Data: Provide electrical characteristics and connection requirements. Submit for acceptance the following product data specifications on:
   a. Control Unit
   b. Power Supplies
   c. Batteries
   d. Door Contacts
   e. Motion Detectors
   f. Acoustic Glass break Sensors
   g. I/O Modules
   h. Telephone Dialer
   i. LCD Keypads

j. Wiring

k. Surge Suppression Equipment

3. Submit Test Reports: Indicate satisfactory completion of required tests and inspections. Submit manufacturer's inspection report.

4. Submit Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

1.8 PROJECT RECORD DOCUMENTS

A. Submit record documents to record actual locations of initiating devices, signaling appliances, end-of-line devices, wire and conduit.

1.9 OPERATION AND MAINTENANCE DATA

A. Submit Operation Data: Operating instructions.

B. Submit Maintenance Data: Maintenance and repair procedures.

1.10 WARRANTY

A. Provide a manufacturer’s warranty on control panel for 2 years and 3 years from date of Final Completion.

PART 2 – PRODUCTS

2.1 GENERAL EQUIPMENT AND MATERIAL REQUIREMENTS

A. All equipment shall be new and unused. All components and systems shall be designed for uninterrupted duty. All equipment, materials, accessories, devices, and other facilities covered by this specification or noted on the contract drawings shall be the best suited for the intended use and shall be provided by a single manufacturer.

B. Provide all components, equipment, parts, accessories and associated quantities required for complete installations. All components may not be specified herein.

C. All devices/components/products shall be suitable for use intended.

D. Materials shall be a product of one manufacturer, installed as a complete system.

E. Wiring shall be color coded, copper of size as required by accepted system manufacturer.

F. Automatic telephone dialer shall be provided for connection to monitoring services agency via telephone wires. Dialer shall contain batteries for emergency operation.

G. All electrical components shall have built-in surge protection.

H. System shall be GE Interlogix NetworX 8E Pinpoint System.

I. Provide applicable back box, enclosures, etc. for each device as required to facilitate installation in location shown on drawings.

J. Provide a suitable computer, as required, for the operation of the intrusion detection system until Final Completion at which time operating system will be loaded onto the owner’s server for his use.

2.2 RACEWAYS

A. General:

1. All raceways (conduit, wireways, pull boxes, outlet boxes, etc.) shall comply with applicable requirements of sections within these specifications.

2. All raceways (conduit, wireways, pull boxes, outlet boxes, etc.) shall comply with all requirements of the manufacturer of the Intrusion Detection System.

B. Conduit: Comply with Section Conduit except as noted below:

1. Pull Cords: Install pull cords in all raceway runs that are installed without cable.

2. Size: Minimum size shall be 3/4 inch conduit.

C. Boxes:

1. All outlet boxes, junction boxes, pull boxes, etc. shall comply with applicable section of these specifications.
2. Boxes shall be sized as required by the system manufacturer and NEC for cables and/or device installed.

2.3 TERMINATION CABINETS

A. Terminal cabinets are to comply with applicable sections of these specifications.

2.4 "SYSTEMS" AND "LOCAL" GROUND BUS

A. Bus to comply with applicable sections of these specifications.

2.5 WIRE/CABLE

A. Provide wire/cable as recommended by manufacturer for proper operation of system and as required to comply with all sections of these specifications.

2.6 ALARM CONTROL PANEL

A. Control Panel: Modular construction with surface wall-mounted enclosure.

B. Power Supply: Adequate to serve control panel modules, and alarm signaling devices. Include battery-operated emergency power supply with capacity for operating system in standby mode for 24 hours.

C. System Supervision: Provide electrically supervised system, with supervised alarm initiating and alarm signaling circuits. Component or power supply failure places system in alarm mode.

D. Initiating Circuits: Supervised addressable loop with alarm and trouble indication.

E. Signal Circuits: Supervised signal module, sufficient for signal devices connected to system; occurrence of single ground or open condition places circuit in trouble mode and does not disable that circuit from transmitting alarm. Use supervised fire zone.

F. Remote Station Signal Transmitter: Electrically supervised, capable of transmitting alarm and trouble signals over telephone lines to central station receiver.

G. Local Alarm: Sound alarm if telephone tie is cut.

H. Surge Protection: Provide on power supply and all circuits entering/leaving building housing main control panel.

I. Entry and Exit Time Delays: Programmable (time).

J. Trouble Sequence of Operation: Upon trouble signal, trouble alarm light is to be activated.

K. Alarm Sequence of Operation: Actuation of intrusion detecting device places system in alarm mode, which causes the following operations:

1. Sound and display local alarm signaling devices with non-coded signal.
2. Transmit non-coded signal to remote station equipment.
3. Indicate location of actuated building on control panel and each keypad.

L. Alarm Reset: Key-accessible reset function resets alarm system out of alarm if alarm initiating circuits have cleared.

M. Control Panel, provided in a “commercial can”, shall be GE Interlogix NetworX Model NX-8E with NX-2192E Point ID Interface Card.

N. Power Supplies shall be GE Interlogix NetworX Model NX-320E Smart Power Supply and Bus Extender

2.7 I/O MODULES

A. Single input addressable module shall be GE Interlogix NetworX Model SI-ID

B. 4 input/4output module shall be GE Interlogix NetworX Model 4140-ID

2.8 KEYPAD

A. The system arming shall be accomplished with an intelligent keypad interface with the capacity for 99 users.

B. The system shall have a lockout feature after an invalid code has been entered twice.

C. The keypad shall indicate status and wait state for arming and disarming, have a duress code and shall provide audible indication during the delayed entry or exit period.

D. Keypad shall be GE Interlogix NetworX Model NX-148 LCD Keypad

2.9 DOOR CONTACTS

A. Recessed mounting.

B. Self-locking magnetic contact suitable for use in metal doors.

C. Provide single input addressable module for each door contact.

2.10 MOTION DETECTOR

A. Passive infrared motion detector (PIR).

B. Adaptive Signal Processing - 3D signal processing with gliding focus mirror optics analyzes size, speed, shape, and adaptive alarm threshold.

C. Coverage: Four 50-foot curtains. Adaptable pattern with supplied inserts.

D. Housing material: Flame retardant ABS

E. Operating Voltage: 8 to 27V (as supplied by NX-2192)

F. Current draw: 250 µA typical avg. 3mA with LED momentarily on

G. Environmental Limits:

1. Operating temperature: 0-degrees to 131-degrees F
2. Relative humidity: 10% to 90% noncondensing.

H. Dimensions: 2.9"W x 2.2"D x 5.1"H

I. Motion detectors shall be addressable and shall be GE Interlogix NetworX Model AP750-ID

2.11 ACOUSTIC GLASSBREAK SENSOR

A. Shatterpro's Pattern Recognition Technology for superior detection and false alarm immunity.

B. Protects all glass types up to a standard thickness of 1/4 inch including plate, wired, tempered and laminated glass. Senses through light blinds and unlined drapes.

C. Sensor shall have a detection radius of 20 feet.

D. Housing material: Flame retardant ABS

E. Operating Voltage: 8 to 27V (as supplied by NX-2192)

F. Current draw: 250 µA typical avg. 3mA with LED momentarily on

G. Microphone: Omni-directional electret

H. Environmental Limits:

1. Operating temperature: 14-degrees to 120-degrees F
2. Relative humidity: 10% to 90% noncondensing

I. Dimensions: 3.13"W x 1.7"D x 4.2"H

J. Acoustic glass break sensors shall be addressable and shall be GE Interlogix NetworX Model 5845-ID.

2.12 SIGNAL DEVICES

A. Alarm Bells: NFPA 72G, electric 8 inch motor bell with operating mechanism behind dome. Sound Rating: 92 dBA at 10 feet. Unit to be rated for exterior wet locations.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions. Provide all interconnections, etc. required.

B. Use 16 AWG minimum size conductors for detection and signal circuit conductors. Install all wiring in conduit. Increase size in conductors as required to keep voltage drop to levels acceptable to manufacturer.

C. Make conduit and wiring connections to door hardware devices.

D. Install all conduit concealed.

E. Install recessed magnetic switch on doors on plans that are indicated to receive door contacts.

F. Install motion detectors at locations indicated on drawings.

G. Install Glass break sensors at locations indicated on drawings.

H. Install keypads at locations indicated on drawings.

I. Install alarm bells at locations indicated on drawings.

J. Install main control panel as indicated on plans in Systems Room.

K. Where location of a required device is not shown on drawings install as directed by owner.

L. Wire each device to control panel and connect/program system to comply with the zoning specified herein or on drawings.

M. All system cables and power wiring shall be kept physically isolated from each other at all points. Lace and form wires from components to terminals and fasten securely.

N. Wires and cables in equipment cabinets and service cabinets shall terminate on terminal strips or on connectors provided with equipment. All terminals must be permanently marked with room numbers. Cable splicing is not acceptable. Contractor shall coordinate exact location of all components of the system and their function with Owner/Architect prior to any rough-in of installation.

O. Coordinate with Owner for names, and instructions to be recorded on dialer.

P. Upon completion of installation of the system, it shall be checked by factory authorized representatives with result of the checkout reported in writing. The written report shall precede or accompany contractor's request for acceptance inspection.

Q. All door contact and motion detector wiring will be home run, pinpoint enunciated, to the security system panel in the building.

R. Four conductor wire shall be used throughout for door contacts, etc. All wiring shall meet or exceed the requirements of the system manufacturer.

S. All wiring shall be run in conduit.

T. Install equipment, cables, and contacts as required to comply with all applicable requirements of the references and/or regulatory requirements called for under PART 1 of this section of specifications, as a minimum installation requirement. Exceed this minimum requirement when called for herein.

U. Install all electrical basic materials per applicable sections of these specifications.

V. Install system equipment panels in locations shown; arrange to provide adequate ventilation and access.

W. Properly ground system per applicable sections of these specifications.

X. Support raceways, backboards, and cabinets under the provisions of Section Supporting Devices, and/or as required by manufacturer's instructions.

Y. Install raceways to conform to applicable sections of these specifications.

Z. Install system wiring and/or raceways away from any surface that may become hot, including, and not limited to, hot water piping and heating ducts.

AA. Install system wiring with at least 12 inches of separation from line voltage power wiring on parallel runs. Wiring crossing power circuits shall be at right angles. For metal enclosed electric light or power or Class 1 circuits, separation may be reduced to 6 inches. Increase separation if so required to comply with EIA/TIA referenced standards.

BB. All raceways shall meet requirement for raceway per applicable requirement of sections within Division 26 of these specifications.

CC. Raceway shall not be shared by power or any other electrical wiring that is not part of the low voltage Intrusion Detection System.

DD. Bend raceway with minimum inside radius of 6 times the internal diameter. Increase bend radius to 10 times for raceway larger than 2 inch size. Provide proper bend for all changes of direction. Pull and splice boxes shall not be used in lieu of a bend.

EE. Install raceways so no more than two 90o bends are in any raceway section without pull box. Install additional pull boxes as required to maintain maximum of two 90-degree bends between pull boxes and/or termination points.

FF. Label all raceway at both ends to indicate destination and Intrusion Detection System source room. Also indicate length of raceway and this labeling/identification shall be fully documented in as-built (record) drawings.

GG. Install polyethylene pulling string in each empty conduit over 10 feet in length or containing a bend.

HH. Fire Stop:

1. Where conduit penetrates a fire rated wall, floor, etc., firestopping shall be provided.
2. Provide permanent firestopping seals after cable installers have pulled risers and distribution cables.
3. Meet all requirements for UL assembly involved. Provide firestopping UL listed for assembly, conduit, and/or cable involved.

II. Pull boxes, Junction Boxes, Outlet Boxes:

1. Install per applicable sections of these specifications and all applicable codes/standards.
2. Boxes shall be placed above accessible ceilings and in an exposed manner and location, and readily accessible. Boxes shall not be placed in a fixed false ceiling space unless immediately above a suitably marked and rated hinged access panel.
3. A pull box shall be placed in a conduit run where:
    a. the length is over 100 feet.
    b. there are more than two 90o bends, or
    c. if there is a reverse bend in the run
4. Boxes shall be placed in a straight section of conduit and not used in lieu of a bend. The corresponding conduit ends should be aligned with each other. Conduit fittings shall not be used in place of pull boxes.
5. Outlet boxes shall be installed at devices requiring outlet box per applicable codes/standards.
6. Provide bushed nipple at devices receiving cable without raceway/conduit.

7. Every pull box shall have a hinged cover. Install appropriate access panel to allow cover to open.
8. Size:
    a. Where a pull box is required with raceway(s) smaller than 1-1/4 trade size, an outlet box may be used as a pull box.
    b. Where a pull box is used with raceway(s) of 1-1/4 trade size or larger, the pull box shall:
        i. Straight Pull-Through:
            a) have a length of at least 8 times the trade size diameter of the largest raceway.
        ii. Angle and U-Pulls:
            a) have a distance between each raceway entry inside the box and the opposite wall of the box of at least 6 times the trade size diameter of the largest raceway, this distance being increased by the sum of the trade size diameters of the other raceways on the same wall of the box; and
            b) have a distance between the nearest edges of each raceway entry enclosing the same conductor of at least:
                i) Six times the trade size diameter of the raceway; or
                ii) Six times the trade size diameter of the larger raceway if they are of different sizes.
        iii. Raceway entering the wall of a pull box opposite to a removable cover:
            a) have a distance from the wall to the cover of not less than the trade size diameter of the largest raceway plus 6 times the diameter of the largest conductor.
9. No box shall be smaller than that required by NEC 314.28 (A), (1) and (2).
10. Grounding:
    a. Provide and install complete grounding system as required to comply with all sections of these specifications and applicable codes.
    b. Connect Terminal Cabinet rack to "systems" ground bus with #6 green insulated copper ground wire.
    c. Connect metal conduit (via grounding bushing) to "systems" ground bus.
    d. Connect cable shields to "systems" ground busbar.
    e. Connect surge suppression equipment to "systems" ground busbar.
11. Surge Suppression:
    a. General
        i. Provide and install surge suppression devices as specified for each system circuit conductor, at both ends at each terminal block terminating conductors between buildings.
        ii. Provide and install surge suppression devices as specified in Section Surge Suppression Equipment for 120-volt source to all equipment. Install online side of each control panel.
        iii. Extreme care shall be taken by contractor to assure a properly surge protected system.
        iv. Surge protection equipment must be selected by contractor to match the equipment being protected including wire sizes, operating volts, amps, and circuit impedance.

v. Installation of surge protection equipment and it's grounding must be per manufacturer's recommendations to assure short and proper ground paths.

b. Equipment Selection

i. Contractor to coordinate with suppliers and installers of all equipment being protected and provide surge suppression equipment which meets these specifications on respective equipment, wires, etc.

c. Equipment Installation

i. Install surge suppression equipment per manufacturer’s recommendation at each wire terminal as noted under Part 1.

ii. Install in surge suppression equipment terminal cabinets, etc. as required to facilitate installation of surge protection equipment and terminal points. Increase size of terminal cabinets (from that shown on drawings) to size required to facilitate installation of surge suppression equipment and terminal blocks.

iii. Locate surge suppression equipment in terminal cabinet nearest each equipment cabinet.

iv. Coordinate with Section Surge Suppression Equipment Contractor to assure that surge suppression for 120VAC power circuit and surge suppression required by this section are all installed in same terminal cabinet and bonded together.

12. Ground Installation

a. Ground Bus Connections.

i. Provide "local" ground bus in each terminal cabinet housing surge protection equipment (with lugs, etc. as required).

ii. Bond "local" ground bus to terminal cabinet with minimum #6 copper wire.

iii. Connect terminal cabinet "local" ground bus to "systems" ground bus installed per Section Grounding and Bonding with minimum #6 copper insulated wire (unless otherwise noted) in conduit.

b. Note that "systems" ground bar is also to be used for power transformation ground (480V to 208V) where applicable.

c. Surge suppression equipment grounding.

i. Connect each surge suppressor to local ground bus in terminal cabinet with wire sized as recommended by manufacturer. Where "M" block type terminations/surge suppressors are used, bond ground rail to local ground bar with wire as recommended by manufacturer.

ii. Coordinate with Section Surge Suppression Equipment contractor to assure that 120VAC power source/supply surge suppressor is also grounded to same local ground bus as surge suppressors provided in this section.

d. Conductors.

i. Conductors shall meet requirements of Section Building Wire and Cable.

ii. Bends in excess of 90 degrees in any grounding conductor shall not be permitted. A radius of 6 inches or greater shall be maintained on all bends.

iii. Do not bundle unprotected conductors with protected conductors.

iv. Conductors shall be kept as short as possible.

v. Conductors shall be secured at 12 inch intervals with an accepted copper clamp.

vi. Grounding conductors shall be properly connected to the building service ground by accepted clamps.

e. Grounding Connectors

i. Connectors, splicers, and other fittings used to interconnect grounding conductors, bond to equipment or grounding bars, shall be accepted by NEC or UL for the purpose.

ii. All connectors and fittings shall be of the Nicopress crimp or compression set screw type.

iii. Special treatment to fittings, lugs, or other connectors of dissimilar material shall be applied to prevent electro-galvanic action.

3.2 FIELD QUALITY CONTROL

A. Field inspection and testing to be performed.

B. Test in accordance with NFPA 72.

3.3 MANUFACTURER'S FIELD SERVICES

A. Prepare and start systems.

B. Include services of technician to supervise installation, adjustments, final connections, system testing, and Owner training.

3.4 DEMONSTRATION

A. Provide systems demonstration.

B. Demonstrate normal and abnormal modes of operation and required responses to each.

C. Be prepared to demonstrate to Design Professional compliance of these specifications by all major items or pieces of equipment, as well as compliance with specifications for entire system at time of turnover. The Contractor shall demonstrate the operation of the system to the Owner during the final inspection.

D. Provide a technician to instruct Owner's personnel in operation and maintenance procedures of system. Instruction scheduled at Owner's convenience. Provide a minimum of 2 four hour training courses to the Owner's personnel at times designated by the Owner.

E. All systems shall be inspected in a fully operational state by a representative of the Department of Risk Management before acceptance by Owner.

3.5 AS-BUILT DRAWINGS

A. Prior to acceptance inspection, the Contractor shall furnish complete as-built drawings of the security system. Compile in book form complete as-built drawings and service manuals with schematics of all components used in the system. As-built drawings to include layout diagrams with appropriate later connection information. Complete cable routings and exact locations of all devices incorporated into the system.

END OF SECTION

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SECTION 28 20 00 - CAMERA SURVEILLANCE SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the sections included under Division 1, General Requirements, are included as a part of this section as though bound herein.

1.2 SYSTEM TO INCLUDE

A. Furnish and install a complete Camera Surveillance System (CSS) including but not limited to all cameras, monitors, lenses, housings, controls, video boosters, cable compensators, digital video recorders, matrix controllers, converters, multiplexers, cabling, interface software/equipment, mounting hardware, etc. for a complete and operating system to provide the functions specified herein.

B. Provide a clear picture free from any interference or distortion from any camera to its assigned monitor or monitors.

C. All components shall be solid state, except camera monitor picture tubes.

D. Provide system complete, including but not limited to:

1. Cameras/housing/lenses
2. Conduit/wire
3. Terminal cabinets/enclosures with terminal boards
4. Monitors
5. All power supplies.
6. Matrix switchers
7. Fiber optic system converters with cable, transmitter/receiver
8. Pan-tilt-zoom equipment, controls, switchers, controllers.
9. Network Video Recorder (NVR)
10. Patch panels and patch cables.
11. Media converters
12. Interface software/equipment

1.3 SYSTEM DESCRIPTION/FUNCTION/OPERATION

A. General:

1. Cameras shall be mounted at approximate locations as indicated on the drawings. Each camera shall be equipped with an appropriate lens to provide the best field of view at each individual location and as specified herein.
2. An indoor or an outdoor enclosure and an enclosure mount shall be provided for each camera location indicated on the drawings and as specified herein.
3. Network Video Recorders (NVR) shall be provided to record scenes from any and all selected cameras. NVR units shall be provided to allow the selected viewing and video recording of each camera in the system.
4. The video output of each camera shall be fed back for viewing to the fiber optic converter (FOC) locations as shown on the drawings.
5. The video viewing monitors in the control location shall allow the sequential or matrix viewing of each camera scene and selected scene of any camera in the system simultaneously to the monitors.

6. Each camera in the system shall have an individual generated and positioned on-screen camera identification number.
7. All video equipment shall be installed with removable video, power, and remote-control cable connectors to facilitate easy removal and replacement if required.
8. Video/pan/tilt/control signals shall be by fiber optic technology from building to control rack in Administration Building.
9. Coordinate all requirements in this section of the specifications with applicable sections of these specifications as required to provide a complete operating system as described herein, including but not limited to:
    a. Door hardware devices.
10. Cameras as noted or scheduled shall have complete pan, tilt and zoom Control from console.
11. Provide a suitable computer, as required, for the operation of the CSS until the date of Final Completion at which time provide all software to the owner for installation on his server.

B. System to include:
1. 20 inch call-up color monitors (Administration)
2. 9 inch color matrix monitors (Rack Mounted)
3. 16 channel network video recorders (as required to support the number of cameras)
4. remote controls for digital video recorders (as required for each recorder)
5. Number of cameras as shown on Drawings.
6. system controllers

1.4 REFERENCES AND REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish Products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

1.5 SUBMITTALS

A. Submit under provisions of Section Submittals.

B. Shop Drawings:
1. Submit plan (on AutoCAD 2006) of building and site showing:
    a. Location of each device.
    b. Raceways.
    c. Quantity and type of wire/cable.
    d. Typical outlet wiring diagram.
    e. Detail drawing of each terminal board/cabinet.
    f. Detail drawing of rack, equipment cabinet, console, etc.
    g. Indicate electrical characteristics and connection requirements, including system wiring diagram.

C. Product Data: Provide showing electrical characteristics and connection requirements for each component.

D. Qualifications: Submit qualifications of system installer.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

F. Submit labeling scheme and sample of label.

G. Contractor shall submit test reports, manufacturer's specification sheets and any other information necessary to determine compliance with material and equipment specifications described herein.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Section Operation and Maintenance Manuals.

B. Operation Data: Include instructions for adjusting, operating, and extending the system.

C. Maintenance Data: Include repair procedures and spare parts documentation.

D. Test Data. Record of results for all outlets tested.

E. Data sheets showing all field labeling used for termination blocks, cable runs, and outlets.

1.7 PROJECT RECORD DOCUMENTS

A. Submit under provisions of the General and Supplemental Conditions of the Contract and Section Common Work Results for Electrical Systems.

B. Submit plan (on AutoCAD Release 2006) of building and site showing actual locations and sizes of raceways, outlets, terminal boards, terminal cabinets, etc.

C. Record actual type and size of cables installed.

D. Record "to and from" locations coordinated with cable labeling for all cables at each terminal board or cabinet.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum 5 years' experience.

B. Supplier: Authorized distributor of specified manufacturer with minimum 3 years' experience.

C. Installer: Authorized installer of specified manufacturer with service facilities within 50 miles of Project.

1.9 MAINTENANCE SERVICE

A. Furnish service and maintenance of premises wiring for one year from Date of Final Completion.

1.10 WARRANTY

A. Provide a manufacturer's warranty for a period of 3 years for date of Final Completion.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide all components, equipment, parts, accessories, and associated quantities required for complete installations. All components may not be specified herein.

B. All devices/components/products shall be suitable for use intended and meet all stated performance requirements for system specified in this section.

C. Provide suitable lens for each camera.

2.2 RACEWAYS

A. All raceways, conduits, supports, etc. comply with applicable section of three specifications.

B. Bushings: Provide insulating bushings on ends of all raceway.

C. Pull Cords: Install pull cords in all raceway runs that are installed without cable.

D. Minimum size 3/4inch.

2.3 BOXES

A. All outlet boxes, junction boxes, pull boxes, etc. shall comply with applicable section of these specifications.

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2.4 TERMINATION BACKBOARDS

A. Material: A/C grade exterior plywood.

B. Size: 8 feet high with width as shown on drawings unless otherwise noted or required in these specifications.

C. Finish: Paint both sides and all edges of terminal board with gray paint having a flame spread rating of Class A as a minimum.

2.5 TERMINATION CABINETS AND/OR ENCLOSURES

A. Terminal cabinets and/or enclosures are to comply with applicable sections of these specifications.

2.6 "SYSTEMS" GROUND BUS

A. Bus to comply with applicable sections of these specifications.

2.7 CAMERAS

A. TruVision™ Megapixel IP Color Camera.

1. General Requirements:
    a. The camera shall be a 2 Megapixel CMOS Progressive Scan IP Camera having real-time video streaming at up to 1280 x 720p for ideal video capturing under challenging conditions. Day/Night functionality to capture images in various lighting scenarios, NTSC, PoE, SDHC Card Slot.
    b. Frame Rate: 10 fps (1600 x 1200), 15 fps (1280 x 720), 30 fps (704 x 480)
    c. Video Bit Rate: 32 kbps to 8Mbps, adjustable
    d. Sensitivity: Color - 0.68 lux @ F1.4; Mono - 0.13 lux @ F1.4
    e. S/N Ratio: > 50 dB
    f. Lens (box): Megapixel 1.3: 2.8 - 8mm F1.2, Auto Iris DC
2. Electrical Specifications:
    a. Voltage Input: 24 VAC, ±10% /12 VDC, ±10%, PoE (IEEE 802.3af)
    b. Power Consumption: 4 watts max.
    c. Power Supply: 48 VDC .38A Wall Mount Power Supply
    d. IO Connection: Screw Terminal
3. Mechanical Specifications
    a. Connectors:
        i. VIDEO OUT: RJ45
        ii. Power: PoE
    b. Dimensions (with housing):
        i. 24VAC Models - approximately 6.25” x 2.57” sq
        ii. 24VAC Models - approximately 1.32 lbs.
4. Environmental Specifications:
    a. The camera shall operate between the temperature limits of -10 to +60 degrees Celsius.
5. Agency Approval Requirements
    a. The camera shall be UL Listed and CSA Certified.
    b. The camera shall comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules.

6. Manufacturer:
    a. Interlogix TVC-M2110-1-N
    b. TVC-M-WM: Box and Clamshell Housing Wall Mount
    c. TVC-OH: Box Outdoor IP 66 Clamshell Housing

B. Ultra View™ Dome IP Camera
1. General Requirements:
    a. The camera shall be a high-res, vandal-resistant, varifocal lens network camera having 4CIF resolution at up to 30 fps, true day/night, IR-corrected varifocal lenses, and polycarbonate dome with captive shroud for easy installation, vandal resistance and to conceal camera position.
    b. Scanning System: 525/60 (NTSC), 625/50 (PAL) 2:1 Interlace
    c. Effective Pixels (H x V): 704 x 480 (NTSC and PAL)
    d. d. Frame Rates: 30, 15, 7.5, 3.5, 2 and 1
    e. S/N Ratio: > 50 dB
    f. Lens: 2.8 to 10.5 mm AI f1.2 IR corrected
2. Electrical Specifications:
    a. Input Voltage: PoE, 12 VDC or 24 VAC
    b. Power Consumption: 7 W PoE; 8 W (DC); 12 W (AC)
3. Mechanical Specifications
    a. Body shall be die-cast aluminum. Dome shall be 3.5 mm thick polycarbonate.
    b. Connectors:
        i. Ethernet Out: 10/100 Mb (RJ 45 connector)
    c. Dimensions (with housing):
        i. 24VAC Models - approximately 5.22 x 4.11”
        ii. 24VAC Models - approximately 3.1 lbs.
4. Environmental Specifications:
    a. The camera shall operate between the temperature limits of -30 to +50-degrees Celsius.
5. Agency Approval Requirements
    a. The camera shall be UL Listed and CSA Certified.
    b. The camera shall comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules.
6. Manufacturer:
    a. Interlogix UVD-IP-XP3DNR-VA2

2.8 MOUNTS

A. Provide mounts as required for each specific application.

2.9 FIBER MEDIA CONVERTER AND PoE INSERTER

A. The media converter will integrate two remote network technologies in a single product - 100Base-FX to 10/100Base-TX Media Conversion with Power Sourcing equipment and a PoE Injector for wireless access points, IP-based surveillance cameras or IP phones.
1. The media Converter shall be capable but not limited to the following:
2. Auto-negotiation for 10/100Base-TX half-duplex or 10/100Base-full-duplex

3. 100Base-FX interface for up to 2km (multi-mode fiber 50µm/125µm) on MC100FX- TX-PoE
4. 48V/0.4A DC power supply
5. Maximum frame size to 1600bytes
6. Auto MDI/MDI-X function
7. Store and Forward Mechanism
8. Auto loop back test function

B. Interface:
1. Copper: 1-port 10/100Base TX RJ45 TP interface with PoE injector function Auto-negotiation, Auto MDI/MDI-X
2. Fiber: 1-port 100 Base-FX Multi-mode, 50/125 µm or 62.5/125 µm optic fiber.
3. Fiber Port Type: SC
4. Cable Distance: 2 km

C. Electrical:
1. Power Requirement: 48V DC, 0.38 A

D. Manufacturer:
1. Interlogix MC100FX-TX-PoE

2.10 SMALL FORMAT PLUGGABLE TRANSCEIVER MODULE

A. Provide a module specifically designed to accommodate high-performance optical fiber, including integrated duplex data link over single mode. Compliant with SFP Multisource Agreement capable of easy installation without interrupting host equipment operating online.

B. Environmental specifications:
1. Temperature: 0 - 70-degrees C.
2. Relative Humidity: 5% - 95% non-condensing

C. Electrical:
1. Input Voltage: 3.3 VDC

D. Manufacturer:

2.11 FIBER OPTIC CONNECTOR

A. The optical connector must be Corning Type SC. The connector must be glued, crimped and covered with a Strain Relief Boot. Provide with appropriate power supplies and accessories.
1. Repeatability: less than .02 dB.
2. Insertion Loss: 0.5 dB (typical).
3. Durability (Mating cycles): 1000.

2.12 FIBER OPTIC CABLE

A. Fiber Specification:
1. Multimode: size 50µm; core 125µ; Buffer 250µ.
2. Maximum attenuation (dB/Km): 2.0
3. Minimum bandwidth (MHz/Km): 300
4. Minimum bend radius: 3 inches
5. Typical loss per fiber (per camera): 5.7dB

B. Fiber Installation:

1. The fiber will be installed in conduit (outside and inside). The company must install the connectors properly to avoid unnecessary signal loss. The installer's company must have a complete installation kit with the appropriate tools such as: Crimp tool, special Epoxy glue, a 100x Microscope for inspection and alignment, a Fiber Cleave tool, two Polishing pads, a Polishing tool and three #7 / #3 / #0.3 polishing film.

2.13 24-PORT PoE SWITCHER/CONTROL SYSTEM

A. General Requirements

1. The video switcher/controller shall be a microprocessor-controlled matrix switching system designed for closed circuit television applications. This video switcher shall be 24 gigabit fiber copper PoE and stacking switch.

B. Environmental Specifications:

1. Temperature: Unit shall operate between the temperature limits of 0 to 50-degrees C, relative humidity 20% to 90% non-condensing.
2. Mounting: Rack mounted

C. Electrical

1. Power Consumption: Full load 110v, 39 watts, 132.99 BTU
2. Input Voltage 100-240VAC, 50/60 Hz, Auto Sensing

D. Hardware Specifications:

1. Copper Ports: 24 10/100/1000Base-T RJ-45 Auto-MDI/MDI-X ports with IEEE 802.3af PoE injector
2. Dimensions: 17.32 x 11.81 x 1.75”
3. Weight: 9.92 lbs.
4. Switch Fabric: Store and Forward

E. Agency Approvals.

1. System shall be UL Listed and CSA Certified and comply with FCC Rules.

F. Manufacturer:

1. Interlogix GE-DSSG-244-PoE

2.14 NVR 16 IP CHANNEL NETWORK VIDEO RECORDER (NVR)

A. The Network Video Recorder (NVR) is to be a TruVision™ NVR 20 (TVN 20) designed to support video streams from IP video Cameras. IP camera support includes resolutions from standard to 5 megapixels from Interlogix and third-party IP camera manufacturers. The NVR 20 also supports Interlogix Ultra View™ Encoder 10 H.264 for integrating existing analog cameras.

B. Additionally, the system shall provide automated alarm handling. Recording options are to include Continuous, Motion, and Alarm or combined scheduled recording modes. Motion recording utilizes an IP camera’s built-in motion detection events. Alarms are to be triggered from any of the 16 on board alarm inputs or from alarm inputs that reside on the IP Camera.

C. Software shall allow remote access to the full capabilities of the recorder via Web browser or TruVision Navigator. The TVN 20 shall allow for easy configuration via IP device auto-discovery tools, and embedded processor technology allowing administration as a network appliance. Software is to be installed on the machine of the owner’s choice.

D. The NVR shall include, but not be limited to the following:

1. Recording Capabilities:
   a. Continuous, Motion or scheduled recording modes
   b. Event recording based upon native IP camera activity detection or via unit alarm input.

c. Video is stored in the native IP camera format.
d. Audio recording with capable IP cameras
e. Redundant camera recording or independent storage groups for different durations.

2. IP Camera Support:
   a. Up to 16 IP cameras based upon model.
   b. Cam Plus™ 2 IP, Ultra View IP plus TruVision 1.3- and 2.0-megapixel cameras
   c. H.264 Axis, Arecont, ACTi and other IP camera manufacturers (VGA and Megapixel)
   d. Ultra View Encoder 10 single-channel H.264 Encoder.
3. Hardware:
   a. Compact rack mountable - 2RU
   b. Up to 16TB of internal storage front accessible drives
   c. GB Ethernet connectivity
   d. 16 on-board alarm inputs and 4 configurable alarm outputs
   e. Local USB archiving.
4. System Configuration and Install
   a. TruVision device finder (discovery of select TruVision DVRs/NVRs and IP cameras)
   b. IP camera auto-discovery in TVN 20 browser
   c. Configuration and viewing via TVN 20 browser or TruVision Navigator software.
   d. No IP camera licensing.
5. Ethernet communications
   a. The NVR shall support LAN/WAN Ethernet access.
   b. The NVR shall support simultaneous Ethernet access by not less than two workstations connected to the LAN/WAN.
   c. The NVR shall support Windows 2000, Windows XP, and Windows Vista
   d. The NVR shall not stop recording during any Ethernet access, nor shall it be possible to remotely issue a command via Ethernet to stop the recording.
6. User Rights: (3-levels)
   a. Administrator, Operator and Guest

E. Manufacturer
1. Interlogix TruVision™ TVN-2016-8T

2.15 20 INCH LCD COLOR VIDEO MONITOR

A. General Requirements
1. The color CSS monitor specified shall use a 20 inch diagonal LCD display.
2. This monitor shall be S-VHS compatible.
3. All user adjustments shall be accessible from the front panel.
4. The monitor shall be capable of reproducing a minimum of 500 lines of horizontal picture resolution.

B. Electrical Specifications
1. The monitor shall operate to specifications within the line voltage range of 105 to 130VAC 60Hz.

2. Nominal power consumption shall be 65 watts with current requirements not to exceed 1.5 amps.
3. The monitor shall accept a 1.0-volt peak to peak, negative sync, composite video input signal.
4. Audio input shall be 390mV RMS (-6dB) high impedance into two RCA phono jacks where one may be used as bridged output or 775mV RMS(0dB) high impedance into EIAJ 8-pin VCR connector.

C. Mechanical Specifications
1. POWER ON/OFF switch shall be push button with separate green LED pilot light.
2. Connectors:
a. Two rear BNC connectors shall allow termination or loop-through of the video signal.
b. Two rear RCA Phono jacks shall provide for audio input/output.
3. Power cord including plug.
4. Dimensions:
5. Weight: lbs.

D. Environmental Specifications
1. Temperature limits:
a. Operating 32 to +104□F
2. Humidity specifications: less than 85% relative, non-condensing.

E. Agency Approval Requirements
1. The CSS monitor shall be UL Listed and CSA Certified.

F. Manufacturer:
1. GE KLC-20 HS with KLC-WM3 wall mount bracket.

2.16 UPS SYSTEM

A. UPS system with 90 minutes of battery back-up for all CSS equipment in console or rack.

2.17 ACCESSORIES

A. Provide and install all accessories to rack mount equipment.

2.18 POWER SUPPLIES

A. Provide and install all required power supplies to match cameras and equipment. Connect to UPS via surge suppression devices. Locate power supplies in equipment rack.

B. Manufacturer: UTC Fire & Security PS48VDC.38A-US or Owner approved equal.

2.19 WALL PLATES

A. Plates to match and meet specifications in wiring device section of these specifications for wiring device plates.

B. Coordinate with other sections of these specifications and provide proper plate for each installation.

C. Color/finish: Comply with Section Wiring Devices.

2.20 CONSOLE

A. The installer's company will design, provide and install a functional and scaled console with all the equipment inside.

PART 3 - EXECUTION

3.1 GENERAL

A. Install in accordance with manufacturer's instructions.

B. Install raceways to conform to applicable sections of these specifications.

C. Finish paint termination backboards with durable gray paint having flame spread rating higher than Class C. prior to installation of telephone equipment.

D. Support raceways, backboards, and cabinets under the provisions of Section Supporting Devices.

E. Install termination backboards and cabinets plumb and attach securely to building wall at each corner. Install cabinet trim plumb.

F. Install recessed cabinets flush with wall finishes, and stub 3 empty 3/4 inch conduits to accessible location above ceiling at each location.

G. Install polyethylene pulling string in each empty conduit over ten feet in length or containing a bend.

H. Mark all backboards and cabinets with the legend "CSS" under the provisions of Section Identification for Electrical Systems.

I. Raceway for CSS wiring shall not be shared by power or any other electrical wiring that is not part of the low-voltage telecommunications systems.

J. Install CSS wiring with at least 12 inches of separation from line voltage power wiring on parallel runs. Wiring crossing power circuits shall be at right angles. For metal-enclosed electric light or power or Class 1 circuits, separation may be reduced to 6 inches.

K. Install CSS wiring and/or raceways away from any surface that may become hot, including, and not limited to, hot water piping and heating ducts.

L. Bend raceway with minimum inside radius of 6 times the internal diameter. Increase bend radius to 10 times for raceway larger than 2 inch size. Provide 10 times bending radius for all fiber optic cable raceway. Provide proper bend for all changes of direction. Pull and splice boxes shall not be used in lieu of a bend.

M. Each CSS outlet shall have a separate, splice-free cable homerun to the local CSS terminal board or cabinet.

N. Label all raceway at both ends to indicate destination and source room. Also indicate length of raceway.

O. All conduit, boxes, jacks, and cable shall be installed as shown on the drawings. Any exceptions to the conduit routing shall be brought to the attention of the engineer before installation.

P. Use branch video cable for circuits less than 500 feet; use main video cable for circuits longer than 500 feet. Provide equalizing amplifier for circuits longer than 100 feet.

Q. Provide raceway, boxes, etc. system as shown on the diagrams and as specified in other sections.

R. In finished areas, conceal conduits and flush mount boxes.

S. Complete installations shall be as recommended by equipment manufacturer. Verify wiring and power requirements.

T. Final connections, balancing, adjustments, testing, etc. shall be factory trained technicians. When system is complete it shall be demonstrated to owner's representative who shall be given complete instructions, part, manuals, and maintenance information.

U. Provide and install system complete including all accessories, conduit/wire, relays, etc. for a complete and operating system.

V. Coordinate work on graphic panel with drawings and other sections of these specifications.

W. Power for all cameras shall be provided via conduit system to cameras from console.

3.2 RACEWAYS, ETC.

A. General: Provide raceway for all telephone wiring.

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B. Minimum size:
   1. Unless specifically noted otherwise on drawings, minimum raceway size for telephone wiring shall be as called for in Part 2 - Products. Increase size if:
      a. So, indicated on drawings.
      b. Required by cable/wire installer.
      c. Required for cable/wire installed in raceway.

C. Each CSS outlet shall have independent/individual raceway to respective terminal board/cabinet.

D. Special Raceway Systems: Special raceway systems may be specified for some portions of the system. Refer to the drawings and other sections of these specifications to determine where or if such systems are used.

E. Pull Boxes: Provide pull box(es) in all conduit runs that:
   1. Exceed 100 feet in length, or
   2. Require more than two 90-degree bends, or
   3. Require a reverse bend.
   4. Install boxes in straight raceway sections. Boxes shall not be used in lieu of a raceway bend.
   5. Every box shall have a hinged cover. Install appropriate access panel to allow cover to open.
   6. Install all boxes in easily accessible locations.
   7. Size per NEC 314.28 (A) (1) and (2).
   8. Pull boxes to conform to applicable sections of these specifications.

F. Pathways/raceways at terminal board locations shall be neatly racked on a Kindorf Type rack secured to wall above and below terminal boards.

G. Where cable tray exceptions have been granted, conduit shall be installed from the wall outlet junction box directly to the tray, allowing no loose cable between conduit and tray.

H. Fire Stop.
   1. Where conduit penetrates a fire rated wall, floor, etc. fire stopping shall be provided.
   2. Provide permanent fire stopping seals after cable installers have pulled risers and distribution cables.

3.3 OUTLETS

A. General: Install CSS outlets where indicated on the drawings.

B. Outlets: Install per applicable section of these specifications (i.e., outlet boxes, indoor service poles, floor boxes, etc.).

C. Wall Plates: Install a blank cover plate similar to that specified for wall receptacles for all CSS outlets which will not have a telephone installed, per Section Wiring Devices.

D. Common Wall: Install outlets with at least 12 inches on-center spacing, or a wall stud, between outlets on both sides of a common wall; 24 inches minimum in rated wall.

3.4 CABLES/WIRES

A. Install cables/wires in accordance with manufacturer's instructions.

B. All cables/wires shall be labeled at each end and at access points along the cable run if the cable run exceeds 50 feet.

C. At a minimum, the label attached to each cable/wire shall indicate:
   1. end points (terminations by room or area designation number) of the individual cable.

2. type of cable.
3. date of cable installation.
4. criticality of cable (i.e., associated with an alarm or life safety system); and d) a unique cable number, assigned sequentially with no gaps.

D. Three copies of a cable record document containing the cable information required on the cable label shall be delivered to the Owner.

3.5 FIBER OPTIC SYSTEM

A. Camera Side: Transmitter.
1. The cable between the camera and the fiber transmitter must be retractable and should combine the video, zoom lens controls, and low power in the same jacket. The housings must include compression glands.
2. The transmitter must be mounted inside a box. Each transmitter must have a stand- alone power supply. This power supply cannot power any other device.

B. Monitoring side: RECEIVER
1. The receiver to be in Rack version. (Plug-In Type).
2. Provide and install power supplies.

3.6 POWER OUTLETS

A. Terminal Boards or Cabinets: Provide one duplex isolated ground receptacles at each terminal board; mount at 7’-6” AFF or in each terminal cabinet.

B. Connect each outlet required above to 20amp, 1P circuit breaker in nearest 120-volt panel (unless specifically shown otherwise on drawings). Provide handle lock-on clip on each circuit breaker.

C. Each outlet to be 20 amp, 120V rated.

D. Connect outlets per NEC and other sections of these specifications.

3.7 TERMINAL BOARDS

A. General.
1. Terminal boards shall be installed secure to wall with bottom of board at 6 inches above floor.

B. Layout. Unless specifically shown otherwise on drawings: 1.4'W x 8'H at locations indicated on drawings.

C. Power.
1. See "Power Outlets" above.

D. Grounding.
1. Ground each terminal board by extending 1 AWG #6 green insulated copper conductor in 3/4" non-metallic conduit from a junction box at terminal board to the nearest accessible acceptable building grounding electrode system as defined in NEC Article 800-100. Where "SYSTEMS" grounding bus/bar (refer to Section Grounding and Bonding) is provided in same room as terminal board, the bus/bar may be used for grounding point if acceptable to telephone system installer and all applicable codes.
2. Locate junction box where directed by telephone installers.
3. Coil a minimum 6 ft. length of conductor pigtail and leave inside junction box.

3.8 TERMINAL CABINETS

A. Install terminal cabinets to conform with applicable sections of these specifications.

3.9 LABELS

A. All CSS components must be easily identifiable for any person that may need to locate telecommunications equipment, facilities, or circuit information.

B. Provide and install permanent cable markers on all cables, etc., at terminal strips, terminal cabinets and at console.

C. All labels must be printed (not handwritten) and applied on all specified CSS components. The label shall be of a type which can be easily applied to CSS components. Label sheets with adhesive backing and a durable surface side is recommended for cables, other components can follow this format, but the contractor must provide details on how labeling will be accomplished, for approval.

3.10 EXTERIOR CAMERAS

A. Exterior cameras shall be mounted in an exterior weatherproof camera housing which shall be complete with a sunshield, and safety chain. Provide 120-volt circuit to exterior cameras.

3.11 CONNECTION

A. All connections (interior/exterior) to be made with liquid-tight flexible conduit securely terminated at both ends.

3.12 TESTING

A. Perform all testing where necessary or specified to assure a fully functional system. Replace and/or repair and retest components that fail performance standards.

B. Test all cables/outlets.

3.13 INTERFACE WITH OTHER PRODUCTS

A. Interface installation of closed-circuit television system with security access and intrusion detection systems (via fire alarm system).

3.14 MANUFACTURER'S FIELD SERVICES

A. Supervise final wiring connections and system adjustments.

3.15 ADJUSTING

A. Adjust manual lens irises (if applicable) to meet lighting conditions.

3.16 DEMONSTRATION

A. Demonstrate system operation and provide 4 hours of instruction with manufacturer’s training personnel.

B. Conduit walking tour of Project and briefly describe function, operation, and maintenance of each component.

3.17 FINAL

A. As built drawings shall be given to operation persons at time of instruction, in addition to those to be supplied as general requirements of the job.

3.18 SURGE PROTECTION

A. Provide, install, and connect new surge suppression equipment as specified in Section Surge Suppression, including protection of equipment power source, cable/wire entering or leaving each and every building. Ground lugs, #6 copper ground wire in 3/4 inch c. to building service ground.

3.19 TESTING, GUARANTEE AND SERVICE

A. See General Requirements Division 1, and Section Common Work Results for Electrical.

B. Upon completion, the system shall be adjusted, tested, and left in perfect operating condition.

END OF SECTION

SECTION 28 31 00 - ADDRESSABLE FIRE ALARM-DETECTION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the sections included under Division 1, General Requirements, are included as a part of this section as though bound herein.

1.2 SUMMARY

A. The work described herein and, on the drawings, consists of all labor, materials, equipment, and services necessary and required to provide and test an automatic fire detection and alarm system. Any material not specifically mentioned in this specification or not shown on the drawings but required for proper performance and operation shall be provided.

B. Drawings and specifications comply to the best of the Engineer's knowledge with all applicable codes at the time of design. However, it is this Contractor's responsibility to coordinate/verify (prior to bid) the requirements of the Authority Having Jurisdiction over this project and bring any discrepancies to the Engineer's attention at least 7 days prior to bid. No changes in contract cost will be acceptable, after the bid, for work and/or equipment required to comply with the Authority Having Jurisdiction.

C. Contractor is advised that circuit routing for this system is not necessarily shown on the project drawings. Contractor shall provide and install all raceways, wiring and cabling required for a complete and fully functional system as intended by these specifications. All wiring and/or cabling shall be in conduit. Contractor shall provide and install a properly sized, flush mounted outlet box for every device. Contractor shall size and route raceways to accommodate the proper installation of the system cabling. T-Tapped cabling shall not be acceptable. In locations where raceway and/or conduit is not accessible after completion of the project, conduit shall be routed from device to device or fire rated access panels shall be installed to provide access to junction and pull boxes. Routing of raceway from device to device shall only be acceptable where the wiring scheme of the system, as recommended by the manufacturer, requires cable to pass from device to device. Contractor shall properly terminate each device according to the manufacturer’s recommendations. Provide and install firestopping where penetrations are made through rated walls and floors. Firestopping is to be performed under Division 7 Section Firestopping.

D. This Specification describes a fully addressable, common fire alarm system, with remote power supplies, remote voice evacuation panels for various buildings and portables.

E. Contractor shall provide and install the fire alarm system (including all equipment, wiring, etc.) in accordance with the manufacturer’s recommendations.

1. Installation of devices shall be in accordance with the manufacturer’s requirements as well as the requirements of the Contract Documents. Recommendations by the Manufacturer for the proper installation of the fire alarm system and its equipment shall not preclude the requirement for the Contractor to comply with the requirements of the Contract Documents.
2. Termination of fire alarm circuits shall be in accordance with the manufacturer’s recommendations, applicable requirements of the National Electrical Code (NFPA 70), National Fire Alarm Code (NFPA 72), ADA, other applicable Codes, and the Contract Documents.
3. Fire alarm Installer shall be responsible for ensuring that prior to bidding the project the Electrical Contractor understands the raceway requirements for the project. Claims by the Contractor after award of the project in regard to additional raceway required either by the fire alarm system manufacturer’s recommendations for proper installation of the system and its associated equipment, or for compliance with the requirements of the Contract Documents, shall not be allowed.

4. Contractor shall note that the drawings show fire alarm remote panels (FARP) in various locations. FARP's are intended to be equipment (remote control panels, power supplies, voice evacuation panels, addressable modules, power, grounding, and any other equipment or materials) necessary for a remote extension of the fire alarm system. FARP's shall be connected to the campus FACP via a signal line circuit (SLC) and other circuits specifically recommended by the fire alarm manufacturer and required to meet the intent of the project documents. An individual FARP shall provide the necessary circuitry (notification appliance circuits (NAC), initiating device circuits (IDC), DC power circuits required by various devices, etc.) to the fire alarm devices within its coverage area. The FARP shall provide interconnection services between the device circuits in its area of coverage and the FACP just as if those device circuits were directly connected to the FACP.

F. The Owner shall be responsible for any retrofits, installation and design required by the local AHJ to comply with the requirements of the 2023 Florida Fire Prevention Code Section 11.10. This code requirement can only be determined after the construction of the building and may or may not be required by the local AHJ in the area of this project.

1.3 DESCRIPTION

A. The Contractor shall furnish and install a complete addressable analog fire detection system. The system shall include but not be limited to:

1. Main Fire Alarm Control Panel (FACP) including all required power supplies.
2. Fire Alarm Annunciator Panel (FAAP).
3. Voice Evacuation System
4. Manual Pull Stations.
5. Smoke Detectors.
6. Duct Detectors.
7. Heat Detectors.
8. Voice Evacuation Speakers
9. Combination Audible/Visual devices (indoor and outdoor weatherproof as indicated on the drawings).
10. Visual Devices (indoor and outdoor weatherproof as indicated on the drawings).
11. Remote Fire Alarm Control Panels (Network Nodes).
12. Remote Power Supplies (Remote power supplies shall be in a UL Listed assembly and be provided by the same manufacturer as the Fire Alarm Control Panel (FACP)).
13. "Do Not Use Elevator" warning lights.
14. Modem for remote service capabilities.
15. "Areas of Rescue Assistance" Equipment (Areas of Rescue Assistance Equipment shall be provided and installed by the Fire Alarm System Installer).
16. Surge Suppression.
17. Programming.
18. Grounding
19. Firestopping (Firestopping is to be performed under Division 7 Section Firestopping).
20. Wire and Cable Labeling.
21. Electrical power required to comply with all functions and operations called for in this section of the specifications. Contractor shall provide and install all 120 VAC circuits as required.
22. Conduit, wire, wire fittings, terminal cabinets with plywood and terminal strips, and all accessories required to provide a complete operating system.

23. A complete and accurate schematic/drawing of the fire alarm system to be placed adjacent to the fire alarm annunciator panel and the main fire alarm panel.

B. Contractor shall furnish and install all equipment (raceways, wire/cable, circuit breakers, modules, relays, etc.) necessary, and as required by applicable code, to accomplish incidental functions of the fire alarm system including but not limited to the following:
   1. Elevator recall, control, and/or shutdown.
   2. Monitoring of sprinkler system and/or fire protection system flow and tamper switches.
   3. Monitoring of sprinkler system and/or fire protection system valve supervisory switches.
   4. Monitoring of post indicator valve (PIV) switches.
   5. Gas/Fuel valve shut off.
   6. Escalator shutdown.
   7. HVAC system control and/or shutdown.
   8. Ventilation system (supply fans, exhaust fans, fan terminal boxes, etc.) control and/or shutdown.
   9. Control of fire, smoke, and/or combination fire/smoke dampers.
   10. Fire suppression and extinguishing systems.
   11. Monitoring of kitchen hood fire suppression systems.
   12. Control of fire and/or smoke doors, dampers, shutters, etc.
   13. Control of door hold open devices.
   14. Control of time out room door lock devices.
   15. Connection to the internet via a local data drop.

C. System shall operate as a non-coded, continuous ringing system which will sound all audible devices, evacuation devices, and activate all visual devices until it is manually silenced.

D. System shall be wired as a Class A system for all circuits.

E. System is to be a complete analog addressable system except for portables. Portables shall be wired as hard-wired circuits.

F. All portions of fire alarm system shall be installed in conduit. Conduit and boxes to be installed by Electrical Contractor.

G. Fire alarm system shall not share a raceway, junction box, enclosure, manhole or device with any other system.

H. Contractor to advise Owner of requirements for monitoring the fire alarm system by Owner's monitoring company and provide all electrical required for remote monitoring including tie to security cabinet.

I. Provide and install wiring, equipment, etc. for connection to devices furnished under other divisions of the work.

J. Provide and install wiring, equipment, etc. as required to deactivate power in the elevator rooms by heat detectors via shunt trip breakers and arm sprinkler pre-action system.

K. Provide and install wiring, equipment, etc. as required to deactivate power to computer power panels and air conditioning equipment by automatic or manual devices as shown on plans.

L. In buildings, two or more floors not fully sprinkled, provide communication equipment, in accordance with all applicable codes, for Areas of Rescue Assistance.

M. Although they may not be indicated on the fire alarm system diagram and/or drawings, all required control and interlock wiring between the fire alarm system and building equipment shall be provided hereunder. Controls are required to/for/from:

1. Fire/smoke air and duct detectors
2. Fire, smoke and/or combination fire/smoke dampers.
3. Supply/Return fans, Exhaust fans, and/or Fan Terminal Boxes (FTB)
4. Automatic fire extinguishing systems
5. Smoke evacuation equipment
6. Sprinkler and/or Fire Protection system components
7. Access Control

N. Provide wiring for Post Indicator Valve Alarms, in each instance in which these are provided under work of Other Trades, connected to Fire Alarm System.

O. Provide and install all relays (electric-electric, electric-pneumatic, and/or pneumatic-electric) as required for a complete and operational fire alarm system, complying with all applicable codes and all requirements, and coordinated with all divisions of these specifications.

P. Provide terminal cabinets sized to house terminal strips and surge suppression equipment.

Q. Surge Suppression

1. The contractor shall have equipment installed on the AC voltage supply and other lines taking care to arrest damaging electrical transient and spikes which can cause damage to the microprocessor components of the system. Central office telephone lines shall have equipment installed to arrest high voltages from electrical and/or lightning from entering the system and causing damage.
2. Provide and install all materials, labor and auxiliaries required to furnish and install complete surge suppression for the protection of building fire alarm system from the effects of induced transient voltage surge and lightning discharge as indicated on drawings or specified in this section.
3. Provide surge suppression equipment at the following locations:
    a. On each conductor pair and cable sheath entering or leaving a building.
    b. On each conductor associated with fire protection (sprinkler) system fire alarm connections.
    c. On all telephone lines.
    d. In other locations where equipment sensitivity to surges and transients requires additional protection beyond that inherent to the design of the equipment. Where equipment being protected has internal surge suppression equipment, the surge protection equipment herein specified is required to be installed in addition to internal equipment protection.

1.4 STANDARDS, CODES, REFERENCES, AND REGULATORY REQUIREMENTS

A. Equipment and installation shall comply with the current or applicable provisions of the following standards:

1. ANSI S3.41 American National Standard Audible Emergency Evacuation Signal
2. National Fire Protection Association Standards:
    a. NFPA 70 National Electrical Code (including but not limited to Article 760, Fire Alarm Systems, Article 770, and Article 800)
    b. NFPA 72 National Fire Alarm Code
    c. NFPA 101 Code for Safety to Life from Fire in Buildings and Structures
    d. NFPA 90A Installation of Air Conditioning and Ventilating Systems
    e. NFPA 96 Ventilation Control and Fire Protection of Commercial Cooking Operations.

3. Underwriters Laboratories Inc. System and all components shall be listed by Underwriters Laboratories Inc. for use in fire protective signaling system under the following standards as applicable:
    a. UL 864 (Category UOJZ) APOU Control Units and Accessories for Fire Alarm Systems. All Control Equipment shall be listed under UL category UOJZ.
    b. UL 268 Smoke Detectors for Fire Alarm Systems
    c. UL 268A Smoke Detectors for Duct Application
    d. UL 217 Smoke Detectors Single and Multiple Station Smoke Alarms
    e. UL 521 Heat Detectors for Fire Protective Signaling Systems
    f. UL 228 Door Closers-Holders with or Without Integral Smoke Detectors
    g. UL 464 Audible Signal Appliances
    h. UL 1638 Visual Signaling Appliances - Private Mode Emergency and General Utility Signaling
    i. UL 1481 Power Supplies for Fire-Protective Signaling Systems
    j. UL 1480 Speakers for Fire Alarm, Emergency, and Commercial and Professional Use
    k. UL 1424 Cables for Power Limited Fire Alarm Circuits
    l. UL 1971 Signaling Devices for the Hearing Impaired
    m. UL 1449, 3rd Edition Standard for Safety for Surge Protective Devices
    n. UL 497 Protectors for Paired-Conductor Communications Circuits
    o. UL 497A Secondary Protectors for Communications Circuits
    p. UL 497B Protectors for Data Communications and Fire Alarm Circuits.
4. All fire alarm equipment, including accessories to the system and including all wires and cable unless otherwise noted, shall be listed by the Underwriters Laboratories product directory called Fire Protection Equipment and/or the Electrical Construction Materials List.
5. Each item of the fire alarm system shall be listed and classified by UL and FM as suitable for purpose specified and indicated.
6. System controls shall be UL listed for Power Limited Applications per NEC 760. All circuits must be marked in accordance with NEC article 760.
7. All equipment supplied as part of the Fire Alarm System shall be provided by a single manufacturer and shall comprise a complete UL Listed Fire Alarm System.
8. IEEE: Fire alarm system includes solid state electronic components. Therefore, the equipment manufacturer shall provide certification that all such equipment is internally protected from, or can withstand, power line surge voltages and currents as specified in Table 1, Location Category A High Exposure of ANSI/IEEE Standard C62.41 1991.

B. Equipment and installation shall comply with the current or applicable provisions of the following codes and laws:
1. Americans with Disabilities Act (ADA): The fire alarm system shall comply with ADA, Public Law 101-336, 1990. The system shall comply with ADA Accessibility Guidelines (ADAAG).
2. Federal Register - Rules and Regulations - Non-discrimination on the basis of Disability by Public Accommodations and in Commercial Facilities.
3. ASME/A17.1- 2016/CSA B44-16 Safety Code for Elevators and Escalators.
4. Local and State Building Codes.
    a. Florida Building Code - 2023.
    b. Florida Administrative Code. All applicable chapters including but not limited to:

i. Chapter 69A Rules, including but not limited to:

a) Ch 69A-3 Fire Prevention - General Provisions

b) Ch 69A-46 Fire Protection System Contractors and Systems

c) Ch 69A-47 Uniform Fire Safety Standards for Elevators

d) Ch 69A-48 Fire Safety Standards for the Fire Alarm Systems

ii. Florida Administrative Code 6A-2/SREF (Schools)

c. Florida Fire Prevention Code - 2023.

d. Florida Department of Insurance:

i. Insurance Code: The fire alarm system and installation thereof shall comply with the State of Florida Department of Insurance rules. The requirements of the Florida State Department of Insurance shall be as promulgated by the Division of State Fire Marshal.

ii. Fire Alarm Rules: The fire alarm system and installation thereof shall comply with the Fire Safety Rules promulgated by the Florida State Fire Marshal.

e. Authority Having Jurisdiction:

i. General: The system shall comply with all applicable Codes, Ordinances and Standards as interpreted and enforced by the local Authority Having Jurisdiction.

ii. Fire Department (AHJ - MCSD Safety, Fire & Health)

iii. Building Official

iv. State of Florida: Division of State Fire Marshal.

C. Surge Suppression

1. Equipment Certification: When available by any one manufacturer, all surge suppression equipment shall be listed by Underwriters Laboratories, shall bear the UL seal, and be marked in accordance with referenced standard. Such surge suppression equipment shall be UL listed and labeled for intended use.

2. Comply with all standards and guides listed under "References" above.

1.5 RELATED SECTIONS

A. All applicable sections of Division 1, Divisions 26, 27 and 28.

B. Applicable sections of these specifications with regard to, but not limited to:

1. Doors
2. Exhaust hoods
3. Elevators
4. Standpipe and fire hose systems
5. Sprinkler systems
6. Extinguishing systems
7. Ductwork accessories: smoke dampers
8. Building control systems
9. School, Intercom System with Time Program Clock Modular Administrative Communications System
10. Local Area Sound System
11. Intrusion Detection System
12. Access Control System

1.6 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum 10 years' experience and with service facilities within 50 miles of Project.

B. Installer:

1. Company specializing in installing the products specified in this section with minimum 10 years' experience.
2. The Installer shall be currently licensed by the Electrical Contractors Licensing Board as a Certified Alarm System Contractor I (EF).
3. The installing Contractor shall be a direct sales division of, or the authorized and designated distributor for, a fire alarm system manufacturer.
4. Installing Contractor shall maintain a local staff of specialists, including a Fire Alarm Planning Superintendent, for planning, installation, and service.
5. The installing Contractor shall maintain an office within 50 miles of the project with capability to provide emergency service 7 days-a-week, 24-hour days. The installing Contractor shall have been actively engaged in the business of selling, installing and servicing fire alarm systems for at least 10 consecutive years going back from date of bid.

C. Surge Suppression

1. All surge suppression devices shall be manufactured by a company normally engaged in the design, development, and manufacture of such devices for electronics/communications systems equipment.
2. The surge suppressor manufacturer shall offer technical assistance through support by a factory representative and local stocking distributor.
3. Verify proper clearances, space, etc. is available for surge suppressor.

D. Coordination/Project Conditions

1. Verify proper grounding is in place.
2. In installations where the electrical contractor does not provide a counterpoise system in conjunction with the underground raceway system, the fire alarm contractor shall provide a coupling conductor within the fire alarm underground raceway system to run alongside fire alarm conductors. Coupling conductors shall be sized according to applicable codes and standards.

E. To establish the type and operating characteristics of the fire alarm system, the equipment specified herein is used as a guide in determining the functions of the fire alarm system. Other equipment will be considered for approval provided the following is submitted in writing by the system installer to the engineer (See Section Common Work Results on Substitutions):

1. Contractor qualifications (as listed above).
2. Complete lists, descriptions, and drawings of materials to be used.
3. A complete drawing showing conduit, conduit sizes, backboxes, number of wires and wire sizes.
4. A complete riser diagram of Fire Alarm System.

F. Acceptable Manufacturers:

1. Basis of Design
   a. Notifier NFS2-3030 [System and all components shall match existing campus manufacturer and be UL listed to interface with all devices for initiation and signaling in all other campus buildings.]

1.7 SUBMITTALS

A. Submit in accordance with Division 1 and Section Common Work Results.

B. In addition to requirements of above, the contractor shall submit:

1. Narrative of operation of System as provided. (Submittal will not be reviewed by the A/E without this narrative.)
2. Manufacturer's data on all products, including but not limited to:
    a. Catalog cut sheets.
    b. Roughing-in diagrams.
    c. Installation instructions. Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
    d. Operation and maintenance manuals.
    e. Typical wiring diagrams and risers.
    f. The contractor shall submit test reports, manufacturers' specifications, and any other information necessary to determine compliance with material and equipment specifications described herein.
3. Submit floor plans to locate all devices. Floor plans shall include entire site and all campus buildings indicating all campus building device integration into new master headend. Wiring diagrams shall include wire and raceway sizes, fire alarm control panels, riser wiring and associated raceway sizes, wiring details, connections, and terminal identification. All devices shall be identified by the same applied identification symbol as shown on the contract documents.
4. Submit all load calculations and cable/wire sizing for each branch of the individual fire alarm field circuits. Wire sizing calculations to prove maximum three percent (3%) voltage drop at all AC voltages and maximum eight percent (8%) voltage drop at all DC voltages.
5. Battery sizing calculations.
6. Submit a detailed step by step testing procedure for a component-by-component system functional checkout and test.
7. Point to point wiring diagrams and block diagrams of system to be installed. Point to point wiring diagrams may be submitted at time of operation and maintenance manuals in lieu of in submittal brochure. Block diagrams shall be required with submittals.
8. Riser diagrams and floor plans showing conduit runs and number of wires. All devices shall be identified by the same applied identification symbol as shown on the drawings.
9. Surge Suppression
    a. Surge protective data for 120-volt power source, power circuit, outside signaling circuit, and exterior incoming circuits from other buildings (if any), and outgoing circuits to other buildings (if any).
    b. Submit Product Data for each type of suppressor:
        i. Dimensions.
        ii. Means of mounting.
        iii. Compliance with UL Standards referenced.
        iv. Compliance with IEEE Standards referenced.
        v. Design type (Hybrid, MOV).
        vi. Size of wire leads.
        vii. Warrantee.

viii. Performance data showing compliance with performance as specified herein.

ix. Complete schematic data on each suppressor type indicating component values, part number, conductor sizes, etc.

x. Manufacturer's certified test data on each suppressor type.

xi. Test data from an independent test laboratory.

10. Name, qualifications, etc. of company providing and installing system.
11. Qualifications of installer. Submit proof installer meets specified requirements.
12. Proof of UL Listing. Indicate the UL listing, the UL classification, and NEC insulation type used for each type of wire to be used in installation of fire alarm and communications system.
13. Manufacturer's drawings showing all dimensions (height, width, and depth) for all cabinets used to house system components. Provide catalog pages, mounting details and specification sheets for all fire alarm system components and rough-in boxes.
14. Submit Florida Registered Firm certificate number.
15. Submit Florida Fire Alarm Contractor's license number.
16. Submit Fire Alarm Technician(s) manufacturer's certification.
17. Detailed drawing of the Fire Alarm Control Panels layout indicating the exact arrangement of all zones, including expansion zones.
18. Coordination Drawing: Coordination CAD drawing of building Fire Command room and equipment layout as shown on drawings, with all panel and rack footprints, using actual manufacturer's dimensions, indicating proper clearances.
19. Network:
    a. Complete description data indicating UL listing for all network components.
    b. Complete sequence of operation of all functions of the network.
    c. A list of every network node address.
    d. A list of every address of every device connected to a network node that is provided for purposes of alarm initiation, status monitoring, supervised notification appliance circuits, and auxiliary control.
    e. Complete network wiring diagrams for all components and interfaces to equipment supplied by others.
20. All drawings required herein shall be on AutoCAD Release 2006 or higher.
21. Where required by Authority Having Jurisdiction submit signed and sealed documents as required by Authority Having Jurisdiction. Where Authority Having Jurisdiction requires shop drawings to be signed and sealed by a Registered Engineer, Contractor is required to submit same and include in his bid all costs associated with having a Registered Engineer other than the design Engineer of Record perform signing and sealing.

1.8 PROJECT RECORD DOCUMENTS

A. Submit in accordance with Division 1, Section Common Work Results and Section Operation and Maintenance Manuals.

B. In addition to the requirements above, the contractor shall submit:

1. Updated and revised contract documents to record actual locations (as-installed) of all equipment, devices, initiating devices, signaling appliances, and end-of-line devices.
2. Record actual type, size, and routing of cables installed.
3. Record all cable identifications.

4. Drawings required herein are in addition to those required under "OPERATION AND MAINTENANCE DATA".
5. All drawings required herein to be on AutoCAD Release 2006 or higher.

1.9 OPERATION AND MAINTENANCE DATA

A. Submit in accordance with Section Common Work Results and Section Operation and Maintenance Manuals.

B. In addition to the requirements of Sections above, the contractor's O & M Manuals shall include:

1. A complete as-installed equipment list, listed by room, with manufacturers' names, model numbers, serial numbers, and quantities of each item.
2. A complete and correct system schematic, showing detailed connections for all parts of the system, including wire numbers, terminal block numbers and layouts, and other designations and coding (point-to-point wiring diagrams). System performance measurements shall be documented as noted elsewhere in this specification.
3. Riser diagrams showing as-installed conduit with pull boxes, outlet boxes, physical cable layouts, part numbers of cable types used, and number of circuits in each conduit.
4. Repair parts list for each and every major equipment item furnished.
5. Service manuals for each and every major equipment item furnished.
6. Manufacturer's warranties and operating instructions for each and every equipment item furnished. Include a copy of the certificate of warranty, signed by both parties.
7. Technical Systems Operations Manual, custom-written by the Contractor, for the purpose of instructing the Owner's operating personnel in the detailed step-by-step operation of the system and preventive maintenance procedures. This manual shall include descriptions of the system components and their relationship to system function. This manual shall be bound separately and labeled appropriately.
8. Surge Suppression
    a. O & M data to include:
        i. All accepted shop drawings, product data, and/or cutsheets.
        ii. Installation, connection, and maintenance information on each type of surge suppression.
        iii. Procedure and/or timetable for recommended periodic inspection of devices to determine continued usefulness.
9. Complete equipment rack layouts showing locations of all rack mounted equipment items.
10. CAD floor plans, prepared at a scale of not less than 1/16" = 1'-0" showing detectors, speaker locations and orientation, rack locations, and all other related device locations.
11. The Contractor/Installer shall videotape the entire training session(s) and submit the video tape with the Operational Manual.

C. Drawings required herein are in addition to those required under Project Record Documents.

1. All drawings required herein shall be on AutoCAD Release 2006 or higher.

1.10 WARRANTY

A. Contractor shall warrant the equipment to be new and free from defects in material and workmanship, and will, within one year from date of Final Completion, repair or replace any equipment found to be defective.

1. No charges shall be made by the installer for any labor, equipment, or transportation during this period to maintain functions.
2. Respond to trouble call within 24 hours after receipt of such a call.

B. Contractor shall guarantee all wiring and raceways to be free from inherent mechanical or electrical defects for 1 year from date of Final Completion.

C. Surge Suppression

1. All surge suppression devices shall be warranted to be free from defects in materials and workmanship for a period of 5) years.
2. Any suppressor which shows evidence of failure or incorrect operation during the warranty period shall be repaired or replaced by the manufacturer and installer at no cost to the Owner.
3. Equipment that is damaged by surges during warrantee period shall be replaced at no expense to Owner.

1.11 ADDITIONAL DEVICES FOR JURISDICTIONAL COMPLIANCE

A. Prior to bid, Contractor shall review plans and specifications carefully for compliance with all codes and in particular, the ADA Requirements and NFPA 72. Contractor shall include in bid price any devices required to provide a fully compliant system. Said additional devices shall be shown on shop drawings submitted by contractor.

B. In addition to the above-mentioned devices, Contractor shall include in his bid price the cost of installing twenty additional audible/visual notification devices (over and above those shown on drawings, required by specifications, or determined by system installed to be required) whose location/need may not become apparent until just prior substantial completion date. At least two weeks prior to substantial completion system shall be fully operational. After system is operational MCSD Safety Representative and the system installer shall review the placement of and coverage provided by visual and audible signals throughout the facility for compliance with all codes and in particular, the ADA Requirements and NFPA 72. System installer shall provide the additional devices at locations where the Architect/Engineer requests for complete coverage. The additional devices shall be installed and fully operational prior to date of Substantial Completion.

C. After the project has had its first annual safety inspection the system installer shall install within one weeks' notice any additional audible/visual signals that have been determined to be required during said inspection from the balance of the twenty additional devices noted above. There shall be at no costs for these added devices provided the total does not exceed the balance remaining of the twenty devices noted above. The final balance of the twenty additional devices included in bid price shall be turned over to the Owner as spare material after any fire alarm issues identified during the first annual safety inspection are resolved.

1.12 MAINTENANCE SERVICE

A. Furnish service and maintenance of fire alarm system for 1 year from date of Final Completion.

1. No charge shall be made by the installer and/or contractor for any labor, equipment, or transportation during this period to maintain functions.
2. Respond to trouble call within 24 hours after receipt of such call.

B. Provide annual testing and inspection of fire alarm system at end of first year in accordance with NFPA 72. Correct any deficiencies found at no cost to the Owner. Affix fire alarm tag to panel.

1.13 MAINTENANCE MATERIALS

A. Provide six keys of each type.

B. Provide three of each type of automatic smoke detector without base.

C. Provide three of each type of surge suppression device.

1.14 PROGRAMMING

A. Contractor shall provide all programming (one original copy on disk or CD ROM of the programming software as provided by the manufacturer) EPROM burners, specialty hardware

(excluding generic computer), all access codes and copyrighted software needed for adding, deleting, and changing devices in the program, for the Owner's use.

1.15 OWNER'S INSTRUCTION:

A. Provide instruction to the Owner's designated personnel upon completion of the system installation. Instruction shall include a functional training session on fire alarm control panel operation and instruction on peripheral device operation, including what are normal indications and alarm indications of each type of new/added device. Videos record all training sessions and deliver 4 copies of tapes to Owner (for use in future training).

B. Contractor shall include in his bid all expenses to send two MCSD representatives to the "End-User Certification Factory Training Course," at the manufacturer's factory. The course shall be specifically designed to allow MCSD representatives the skills they need to successfully design, input, and modify, a database that will control the Fire Alarm System. The course shall also provide the skills to install, service and maintain the Fire Alarm System; Factory training for MCSD Representative shall be completed prior to substantial completion of the project. Training shall provide instructions, licensed software, access codes, documentation program material, non-assignable and non-exclusive license for in-house use of the licensed software, and any other requirement to allow MCSD the capability to add, delete or change devices in the program for the Fire Alarm/Detection system.

1.16 SYSTEM OPERATION

A. System operation shall meet the operation requirements of all codes and regulatory requirements.

B. Upon activation of the Fire Alarm System by a manual station, smoke detector, or any other new or existing automatic device the following shall take place:

1. Energize all alarm signaling devices.
2. Sound all audible (horn or speaker) alarms and flash visual signals throughout the campus.
3. Alert proprietary system.
4. Cause alarm to be displayed on the annunciator section of the control panel.
5. Cause alarm to be displayed on remote annunciator.
6. Close all doors or fire shutters, held open by automatic release devices throughout the facility, (coordinate with architect and door hardware supplier, provide all electrical required).
7. Unlock all electrically locked time-out or access control doors (coordinate with the architect and door hardware supplier, provide all electrical required).
8. Shut down all air handlers, exhaust fans supplying or exhausting air, and fan terminal boxes (FTB).
9. Shut all fire and/or smoke dampers in ducts associated with the air handling units and exhaust fans which are shut down.
10. Transmit signals to the building elevator control panel to initiate return to the main floor or alternate floor.
11. Transmit signals to the building automation system to tell system that the fire alarm system has taken control of respective mechanical system.
12. Send a signal to all dimming and lighting relay/control systems. Fire alarm signal shall initiate dimming system controls to drive all dimmed circuits to immediate full-on output. Fire alarm signal shall initiate lighting relay/control system to turn on all emergency lighting circuits.
13. Send a signal to all non-fire alarm sound reinforcement systems (i.e., Cafeteria, Gymnasium, Multi-Purpose Room, Theater, etc.). Fire alarm signals shall override all other sound systems. Alarm notification signals shall take precedence over all other signals. Operation of other sound systems shall resume after fire alarm system clears alarm.

14. Activate the system dialer and transmit the signal to the monitoring contractor, to notify the local Fire Department.

C. Elevator: Smoke detectors associated with elevator lobbies, hoist ways and machine rooms shall be types accepted by the Florida State Fire Marshal under FAC Chapter 69A-47 Uniform Fire Safety Standards for Elevators. Elevator recall shall be initiated ONLY by elevator lobby, hoist ways and machine room smoke detectors. In addition to those functions outlined in "B" above, elevator detector(s) shall initiate the following functions.

1. Operation of any one Elevator Lobby or Hoist way Product of Combustion Detectors associated with a single bank of elevators shall signal the elevator controls to commence required procedures for that bank of elevators. Refer to Division 14 for required procedures, floor(s) of recall, and alternate floor(s) of recall.
2. Operation of any elevator machine room Product of Combustion Detector that is part of this Fire Alarm System shall signal the elevator controls to commence required procedures for that bank of elevators. Refer to Division 14 for required procedures.
3. Activation of the smoke detector(s) in a machine room or hoist way shall cause a suitable warning light to flash. The light is to be located adjacent to the "Phase One" recall switch or elevator hall button at the designated and alternate fire department access level.
4. Fire Alarm system shall monitor shunt trip voltage per NFPA 72.

D. System supervisory faults, such as shorts, opens, and grounds in conductors, operating power failure, or faults within supervised devices, shall place the system in the trouble mode, which causes the following system operations:

1. Visual and audible trouble signal indicated by zone at the fire alarm control panel.
2. Visual and audible trouble signal indicated at remote annunciator panel.
3. Trouble signals transmitted to central station.
4. Manual acknowledgement function at fire alarm control panel shall silence audible trouble signal; visual signal shall be displayed until initiating failure or circuit trouble is cleared.

E. Alarm Reset: The system shall remain in the alarm mode until manually reset with a key accessible reset function. The system shall reset only if the initiating circuits are cleared.

F. Lamp Test: manual lamp test function causes alarm indication at each lamp on the fire alarm control panel and the remote annunciator.

G. When the fire alarm system is activated as a drill, all incidental functions shall be exercised including notification of the fire department.

H. Where required by codes or Authority Having Jurisdiction:

1. When system is silenced by silence switch in control panel, audible alarm is to silence but visual alarm devices are to continue to operate.

I. Fire sprinkler valve tamper switch, when closed, shall annunciate a supervision signal at the fire alarm control panel and annunciator panels, if any. This supervision signal shall not cause a general alarm.

J. Operation of auxiliary contacts in control panel to shut all smoke dampers in ducts associated with air handling units and exhaust fans which are shut down. (These shall not be controlled from detector unit contacts.)

1.17 ZONING

A. Alarm Zones.

1. Regardless of the number of zones shown on drawings, the minimum alarm zones required are:
   a. One per building, per floor for pull stations.

b. One per building, per floor for automatic devices.

c. One for each duct smoke detector).

d. Each device shall be individually annunciated/addressable.

B. Notification Zones.

1. Regardless of the number of zones shown on drawings the minimum notification zones (horns and strobe lights) required are:

a. One (or more) circuit(s) for administration building

b. One (or more) circuit(s) for exterior horns

c. One (or more) circuit(s) for each building with voice evacuation

d. One (or more) circuit(s) for remainder of campus.

2. Breakdown circuits as required for load and distances involved.

PART 2 - PRODUCTS

2.1 GENERAL EQUIPMENT AND MATERIAL REQUIREMENTS

A. All equipment shall be new and unused. All components and systems shall be designed for uninterrupted duty. All equipment, materials, accessories, devices, and other facilities covered by this specification or noted on the contract drawings shall be the best suited for the intended use and shall be provided by a single manufacturer. System shall be provided with all required panels, terminal cabinets, , pathways, wiring, devices, and equipment to provide full integration to control, signal, and annunciate all devices, zones, and panels in each campus building on the new Administration building single campus headend fire alarm control panel. Contractor shall thoroughly investigate site prior to bidding to assure all requirements for campuswide master control and integration are included in the bid package.

2.2 RACEWAYS

A. General:

1. All raceways (conduit, wireways, pull boxes, outlet boxes, etc.) shall comply with applicable requirements of sections within Division 26 of these specifications.

2. All raceways (conduit, wireways, pull boxes, outlet boxes, etc.) shall comply with all requirements of the manufacturer of the fire alarm system.

B. Conduit: Comply with Section Conduit except as noted below:

1. Pull Cords: Install pull cords in all raceway runs that are installed without cable.

2. Size: Minimum size shall be 3/4 inch conduit.

C. Boxes:

1. All outlet boxes, junction boxes, pull boxes, etc. shall comply with applicable section of these specifications.

2. Boxes shall be sized as required by the fire alarm system manufacturer and NEC for cables and/or device installed.

2.3 TERMINATION CABINETS

A. Terminal cabinets are to comply with applicable sections of these specifications.

2.4 "SYSTEMS" AND "LOCAL" GROUND BUS

A. Bus to comply with applicable sections of these specifications.

2.5 FIRE ALARM CONTROL PANEL (FACP)

A. General

1. Fire alarm control panel shall be of dead front construction and be modular in design. Control panel shall be capable of future expansion and shall provide active signal initiating as noted

on drawings (or as herein) specified with zones as noted on drawings (or as herein specified). Control panel shall provide provisions for future expansion. Fire alarm control panel shall be semi-flush mounted (unless otherwise noted on drawings) and located as shown on the drawings.

B. System Capability

1. Communication with addressable devices: The system must provide communication with all initiating and control devices individually. All these devices are to be individually annunciated at the control panel. Annunciation shall include "Alarm", "Trouble", "Open", "Short", "Ground", "Device Fail" or "Incorrect Device" conditions for each point.
2. All addressable devices are to have the capability of being disabled or enabled individually.
3. Each Signal Line Circuit (SLC) two-wire loop shall be capable of addressing a minimum of 99 addressable devices and 98 monitor or control modules.
4. Identification of Addressable Devices: Each addressable device must be uniquely identified by an address code entered on each device at time of installation. The use of jumpers to set address will not be acceptable due to the potential of vibration and poor contact.
5. Wiring Type, Distances, Survivability and Configurations: The system must allow up to 2,500 feet wire length to the furthest addressable device. Style 4 Signaling Line Circuit (as defined by NFPA 72) communications will be provided.
6. System shall be capable of addressable devices and conventional devices within the same system.
7. All system circuits shall be inherently power limited per NEC 760.
8. System shall be capable of communication with a minimum of 15 remote module locations.

C. Master Controller

1. Master controller shall be an integral part of the control panel and be microprocessor-based.
2. Master controller shall store all programming in non-volatile memory.
3. Master controller shall have an event log capable of storing a minimum of 255 events in non-volatile memory.
4. Master controller shall include an 80 character Liquid Crystal Display.
5. Master controller shall include, as a minimum, switches to accomplish Alarm/Trouble Acknowledge, Alarm Silence, Trouble Silence and System Reset.
6. Master controller shall include, as a minimum, LED's to indicate System Alarm, System Trouble, Supervisory Alarm and System Silence.
7. Master controller shall support connection of serial remote annunciators.
8. Master controller shall provide a minimum of two notification appliance circuits (Class A, Style Z or Y).
9. Master controller shall be capable of being expanded as necessary to accommodate all required modules.

D. Notification Appliance Circuits

1. Notification Appliance Circuits Module shall provide fully supervised style Z or Y (Class A indicating circuits. These circuits shall be supervised, provide power or audio to horns, strobes, and speakers. Horns and strobes with polarity reversing loops containing up to 1.75 amperes of 24 Volt notification devices. Speaker circuits with 25 or 70 Vrms containing up to a 40 Watts speaker load.
2. Module shall be provided with pluggable contact wiring terminal strips for ease of installation and service. The terminal strips shall be UL listed for12 AWG wiring.

E. Power Supply

1. Power supply for the panel and all fire alarm peripheral shall be integral to the control panel. Power supply shall provide all control panel and peripheral power needs as well as 3.0 amperes of unregulated 24 VDC power for external audio-visual devices. Audio-visual power may be increased as needed by adding additional modular expansion power suppliers. All power supplies shall be designed to meet UL and NFPA requirements for power-limited operation on all external signaling lines, including initiating circuits and indicating circuits.
2. All power supplies shall be provided by the same manufacturer as the fire alarm control panel (FACP). Power supplies provided by manufacturers other than the manufacturer of the fire alarm control panel (FACP) shall not be acceptable.
3. Circuit breakers or other over-current protection on all power outputs.
4. Input power shall be 120 VAC, 60 Hz. Power supply shall provide internal batteries and charger. Internal battery capacity shall be as required.
5. Battery pack shall provide maximum normal operating and supervisory power for:
    a. 24 hours per NFPA 72
    b. Provide low maintenance gel cell type batteries with sufficient ampere-hour rating to meet the above NFPA Standard and to operate all alarm signals for a duration of 15 minutes at the end of the required period of time.

F. Modem

1. A modem shall be provided as an integral part of the fire alarm control panel (FACP). The modem shall provide the Owner with the ability to accomplish the following functions:
    a. View device sensitivity information.
    b. View system activity in real time.
    c. Access and view the system history log.
2. Modem shall not allow changes to system programming.
3. Modem shall operate at a minimum speed of 9600 baud.
4. Modem shall provide an RJ-11 connector for connection to a telephone line.
5. Fire alarm contractor shall coordinate with the Premise Distribution System (PDS) contractor and/or the Telephone System contractor for interconnection to a telephone line. Telephone interconnection wiring up to the modem shall be provided by the PDS or Telephone contractor.
6. The modem shall mount inside the fire alarm control panel (FACP).

G. Wall Mount Equipment Enclosure

1. The control panel, and all associated equipment, shall be housed in an enclosure designed for mounting directly to a wall or vertical surface. The back box and door shall be constructed of 16-gauge steel with provisions for electrical conduit connections into the sides and top. The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators.
2. The enclosure(s) shall be of sufficient size to house all equipment required for this project. All equipment shall be mounted in the enclosure(s) as designed by the manufacturer. Provide enclosures in quantities as required to provide a complete, UL Listed Fire Alarm system.

2.6 REMOTE ANNUNCIATOR

A. Fire Alarm Annunciator Panel (FAAP) shall be a serial annunciator panel and must be capable of being mounted in a remote location.

B. Annunciator shall be modular using low current circuitry. The annunciator shall be capable of operating on nominal 24 Vdc and be battery backed up.

C. Annunciator modules shall be capable of activating local or remote LED's, relays, or graphic panels.

D. All switches shall be a point in the system and be capable of controlling any system output or functions. All LED's and outputs shall be capable of being controlled by any change of state in the system or as a result of a time control, sequence or logic function. LED's and switches shall be able to be clearly marked by the end user.

E. Modular components of the annunciator shall be mounted in a recessed cabinet with hinged door and a Lexan window with key lock.

2.7 VOICE EVACUATION SYSTEM

A. The voice evacuation system shall provide 50- or 100-Watt signal power and 50- or 100-Watts voice power as required and shall be UL listed.

B. All speaker circuits shall be field selectable for 25 or 70 Vrms operation and shall be power limited. Non-power limited circuits are not acceptable.

C. The voice evacuation system shall be microprocessor based, and shall contain an integral microphone, 50- or 100-Watt audio amplifier (as required), tone generator, digital message repeater, 120 VAC power supply, and battery charger.

D. The voice evacuation message/signal shall be broadcast until the Fire Alarm Control Panel (FACP) is reset, or until fire emergency personnel interrupt the broadcast with a manual page. On reset system shall automatically return to standby (normal operating) condition.

E. A secondary message shall be provided that can be triggered by the closure of a contact from either the FACP or from any normally open contact device.

F. Remote paging microphone(s) will be supported by the system through a supervised circuit. Remote microphone(s) may be mounted up to 5,000 feet away from the voice evacuation panel.

2.8 MANUAL STATION (NON-BREAK GLASS)

A. Manual fire alarm station shall be non-code, non-break glass type providing noncoded signals and operating with a double action motion. Upon actuation, they shall not be restorable to normal except by use of a key. The key shall also allow stations to be tested nondestructively. The stations shall be constructed of metal, with operating directions provided on the cover in highlighted, embossed lettering. The words "FIRE ALARM" shall appear on the door in embossed letters one-half inch high or larger. Mount at 48 inches above finished floor to top and in accordance with NFPA and handicap standards. Manual stations shall be UL listed. Unit shall be equipped with an addressable interface module. Stations constructed of plastic will not be acceptable.

2.9 PHOTOELECTRIC SMOKE DETECTOR

A. The contractor shall furnish and install Analog addressable photoelectric smoke detectors, as called for on drawings. The combination detector head, and twist-lock base shall be UL-listed compatible with a UL-listed fire alarm panel.

B. Smoke detector shall have a flashing, status-indicating LED for visual supervision. When the detector is actuated, the flashing LED will latch on steady and at full brilliance. The detector may be reset by actuating the control panel reset switch.

C. Sensitivity of the detector shall be monitored without removal of the detector head. Metering test points shall be accessible on the exterior of the detector head. Field adjustment of the sensitivity shall be possible when conditions require a change.

D. Vandal-resistant, security locking feature shall be used in those areas as indicated on the drawings. Locking feature shall be field removable when not required.

E. It shall be possible to perform a functional test of the detector without the need of generating smoke. Test method must simulate effects of products of combustion in the chamber to ensure testing of all detector circuits.

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F. To facilitate installation, detector shall be non-polarized. By using a furnished wire jumper, it shall be possible to check circuit loop continuity prior to installing the detector head.

G. Voltage and RF transient suppression techniques shall be employed to minimize false alarm potential. A gated alarm output shall be used for additional detector stability.

2.10 DUCT MOUNTED SMOKE DETECTOR

A. Duct Mounted Smoke Detector for the fire and smoke detection system shall be a high velocity rated Analog addressable series smoke detector intended for use with ventilation and conditioning ducts.

B. Detector shall provide detection of combustion gases and smoke in air conditioning ducts in compliance with NFPA 90A. Detector shall be UL-listed specifically for the use in air handling systems.

C. Detector shall operate at air velocities ranging from 300 feet per minute to 4000 feet per minute without requiring compensation for operation at specific air velocities. Sampling tubes of proper length shall be provided and installed to match duct width at the installed location.

D. Whether shown on drawings or not, a remote alarm indicator/test station shall be provided for each duct mounted smoke detector to annunciate smoke detector operation remotely. Mount unit in ceiling or wall near respective remote smoke detectors (in an occupied space).

E. Detector shall be zoned so that when either the supply or the return detector senses smoke it will cause a supervisory/trouble indication at the main fire alarm panel and immediately shut down the air handler. The duct mounted detectors are NOT to cause a general alarmto sound.

2.11 PROJECTED BEAM SMOKE DETECTOR

A. Contractor shall furnish and install Projected Beam smoke detectors, as called for on drawings. Detector shall include both the emitter and the receiver and be UL-listed compatible with a UL-listed fire alarm panel. Detector shall provide a Form A dry contact for alarm and Form B contact for trouble.

B. Smoke detector shall have a status-indicating red LED for visual supervision. When the detector is actuated, the LED will illuminate on steady and at full brilliance. Detector may be reset by actuating the control panel reset switch.

C. Detector shall have a range of 35 feet to 320 feet. Detector shall be field adjustable to one of the obscuration settings of 25%, 50% or 70% per span. These settings shall be capable of being verified with calibrated filters.

D. Projected Beam smoke detector shall possess circuitry that automatically compensates for normal ambient changes in the intensity of the emitted beam strength. The microprocessor shall provide compensation for a change in received signal value over time, caused by contamination of the optics. When this compensating capability reaches a limit, the microprocessor automatically generates a trouble signal.

E. Projected beam smoke detector shall also signal a trouble condition if the beam has a blockage of 90% for more than 20 seconds and automatically reset to normal when the blockage is removed.

F. It shall be possible to perform a functional test of the detector without the need of generating smoke. The test method must simulate effects of products of combustion in the chamber to ensure testing of all detector circuits.

G. To facilitate installation, the detector shall employ signal strength indicating LED. Alignment is facilitated by turning an alignment adjustment wheel and monitoring the relative signal strength based upon which LED is lit. The detector shall be installed in accordance with the instructions provided with every unit and the listed Installation, Operation and Maintenance Manual, and the applicable NFPA standards.

H. Projected Beam smoke detector shall include an Addressable Monitor module and a Power Supervisory relay.

I. Voltage and RF transient suppression techniques shall be internal circuitry of the detector to minimize false alarm potential.

2.12 HEAT DETECTORS

A. Contractor shall furnish and install Analog addressable heat detectors, as called for on drawings. Combination detector head and twist-lock base shall be UL-listed compatible with a UL-listed fire alarm panel.

B. Heat detector shall have a flashing, status-indicating LED for visual supervision. When the detector is actuated, the flashing LED will latch on steady and at full brilliance. Detector may be reset by actuating the control panel reset switch.

C. Fixed temperature automatic heat detectors shall be rated at 135-degrees F (unless otherwise noted or required due to ambient conditions, i.e., Kiln Room). Fixed temperature element shall use dual thermistor technology. Detectors shall have a smooth ceiling rating of 900 square feet. When required, detectors shall be equipped with two Form 'A' contacts with rating of 3 amps at 6 to 125 volts A.C. and 1 amp at 6 to 28 volts DC.

D. Detectors shall be installed in accordance with appropriate articles of National Fire Protection Association and the spacing rating assigned by the Underwriters Laboratories and located as shown on the drawings. Automatic heat detectors shall be Underwriters Laboratories and Factory Mutual approved.

E. Where indicated on the drawings, the Contractor shall provide heat detectors rated, by the manufacturer, as explosion proof. If not an integral part of the heat detector assembly, the addressable module shall be located outside the area protected by the explosion proof heat detector (but interior to the building) in an accessible area. If the addressable module is located above a gypsum board ceiling the Contractor shall provide a fire rated access panel.

2.13 ADDRESSABLE MODULE

A. Analog addressable device shall be furnished as required to monitor fire alarm or supervisory initiating devices or control auxiliary functions. Each module shall contain address switches to assign a unique input point for programming or control by the system.

2.14 RELAYS

A. Relays required for control (i.e., Air Handler shutdown, Supply Fan shutdown, Exhaust Fan shutdown, Fan Terminal Box shutdown, Door Lock release, Fire Shutter release, Smoke Damper closure, Fire Damper closure, Smoke/Fire Damper closure, or any other interface required by these specifications or applicable codes) shall be UL Listed relays suitable for use in Fire Alarm systems.

B. Per NFPA, relays used for control of other systems shall be located within 3 feet of the device to be controlled.

C. Relays shall be analog addressable devices powered and controlled from the fire alarm system. Each relay shall contain address switches to assign a unique input point for programming or control by the system.

D. Each relay shall provide at least one set of Form "C" dry relay contacts.

2.15 AUDIBLE NOTIFICATION DEVICES

A. Audible notification devices shall be wall mounted at each location designated on the drawings and/or as specified herein.

B. The audible notification device shall include screw terminals for in-out field wiring. The device shall surface mount to a standard 4 inch sq. x 2-1/8 inch backbox.

C. The audible notification devices shall be UL listed for fire protective service and shall provide 24 VDC inputs and sound output of not less than 75 dBA at 10 feet, or more than 120 dBA at the minimum hearing distance from the audible appliance.

1. Audible notification device shall be compliant with ANSI S3.41 for signal character conformance.

D. Audible notification devices located on the exterior of a building, or in a damp or wet location, shall be a weatherproof version and rated, by the manufacturer, for use in wet locations.

2.16 AUDIBLE/VISUAL NOTIFICATION DEVICES

A. Audible/visual notification devices shall be wall mounted at each location designated on the drawings and/or as specified herein.

B. Audible/visual notification device shall include screw terminals for in-out field wiring. The device shall surface mount to a standard 4 inch sq. x 2-1/8 inch backbox.

C. Audible portion of the audible/visual notification devices shall be UL listed for fire protective service and shall provide 24 VDC inputs and sound output of not less than 75 dBA at 10 feet, or more than 120 dBA at the minimum hearing distance from the audible appliance.

1. Audible portion of the audible/visual notification device shall be compliant with ANSI S3.41 for signal character conformance.

D. Audible portion of audible/visual notification devices located on the exterior of a building, or in a damp or wet location, shall be a weatherproof version and rated, by the manufacturer, for use in wet locations.

E. Visual portion of the audible/visual notification devices shall comply with the Americans with Disabilities Act which includes the following:

1. Lamp shall be a xenon strobe type or equivalent.
2. Color shall be clear or nominal white (i.e., unfiltered, or clear filtered white light).
3. Maximum pulse duration shall be two-tenths of one second (0.2 sec) with a maximum duty cycle of 40 percent. Pulse duration is defined as the time interval between initial and final points of 10 percent of maximum signal.
4. Intensity shall be a minimum of 75 candela. Use of visual devices rated at 15/75; 15 or 30 candelas shall not be acceptable.
5. Flash rate shall be a minimum of 1 Hz and a maximum of 3 Hz.
6. More than two visible notification appliances in the same room or adjacent space within the field of view must flash in synchronization. This requirement shall not preclude synchronization of appliances that are not within the same field of view.

F. A suitable polycarbonate cover shall be provided to protect devices at locations where they may be subject to damage such as Gymnasiums.

2.17 VISUAL NOTIFICATION DEVICES

A. Visual notification devices shall be wall mounted at each location designated on the drawings and/or as specified herein. Visual notification devices shall be of the flashing type in compliance with Americans with Disabilities Act.

B. Visual notification devices shall comply with the Americans with Disabilities Act which includes the following:

1. Lamp shall be a xenon strobe type or equivalent.
2. Color shall be clear or nominal white (i.e., unfiltered, or clear filtered white light).
3. Maximum pulse duration shall be two-tenths of one second (0.2 sec) with a maximum duty cycle of 40 percent. Pulse duration is defined as the time interval between initial and final points of 10 percent of maximum signal.

4. Intensity shall be a minimum of 75 candela. The use of visual devices rated at 15/75; 15 or 30 candelas shall not be acceptable.
5. Flash rate shall be a minimum of 1 Hz and a maximum of 3 Hz.
6. Fire alarm system strobes within same room shall flash in synchronization as required by NFPA.
7. More than two visible notification appliances in the same room or adjacent space within the field of view must flash in synchronization. This requirement shall not preclude synchronization of appliances that are not within the same field of view.

C. A suitable polycarbonate cover shall be provided to protect devices at locations where they may be subject to damage such as Gymnasiums.

2.18 VOICE EVACUATION SPEAKER/VISUAL NOTIFICATION DEVICES

A. Speaker/visual notification devices shall be wall/ceiling mounted at each location designated on the drawings and/or as specified herein.

B. Audible/visual notification device shall include screw terminals for in-out field wiring. The device shall surface mount to a standard 4 inch sq. x 2-1/8 inch backbox.

C. Speaker portion of the speaker/visual notification devices shall be UL listed for fire protective service and shall provide 25 VMS or 70VMS inputs and sound output of not less than 85 dBA at 10 feet.
1. Speaker shall be field configurable with taps at 1/4, 1/2, 1, or 2 watts.
2. Speaker shall have a frequency response: 250 to 5000 Hz.
3. Speaker shall have a sealed back construction.
4. Speaker shall include a DC blocking capacitor to allow electrical supervision of the audio distribution circuit.
5. Speaker installation shall meet all UL 1480 standards for Fire Alarm.

D. Visual portion of the audible/visual notification devices shall comply with the Americans with Disabilities Act which includes the following:
1. Lamp shall be a xenon strobe type or equivalent.
2. Color shall be clear or nominal white (i.e., unfiltered, or clear filtered white light).
3. Maximum pulse duration shall be two-tenths of one second (0.2 sec) with a maximum duty cycle of 40 percent. Pulse duration is defined as the time interval between initial and final points of 10 percent of maximum signal.
4. Intensity shall be a minimum of 75 candela. Use of visual devices rated at 15/75; 15 or 30 candelas shall not be acceptable.
5. Flash rate shall be a minimum of 1 Hz and a maximum of 3 Hz.

E. More than two visible notification appliances in the same room or adjacent space within the field of view must flash in synchronization. This requirement shall not preclude synchronization of appliances that are not within the same field of view.

F. A suitable polycarbonate cover shall be provided to protect devices at locations where they may be subject to damage such as Gymnasiums.

2.19 ELEVATOR WARNING LIGHT WITH FLASHER

A. Provide complete, indicating light with flasher per FAC 69A-47. Install label as required.

2.20 WEATHERPROOF COVER (FOR AUDIBLE AND/OR VISUAL DEVICES)

A. Constructed of clear polycarbonate.

B. For flush or surface mount devices.

C. Provide slotted version for audible/visual devices.
   1. Maximum of 5 dB loss.
   2. Provide with brass weep hole.
D. Provide un-slotted version for visual only devices.
   1. Maximum of 3 candela light intensity loss up to 110 candela light source.
   2. Provide without weep hole.
E. Provide with weather gasket.
F. Spacers for additional depth as required.
G. Provide with tamper proof screws.
H. Design criteria:
   1. Safety Technology International, Inc. #1220 (audible/visual) or #1221 (visual) series.

2.21 PULL STATION SECURITY COVER

A. Provide where pull station devices are required to be protected as indicated on the drawings.
B. Shall be UL Listed.
C. Constructed of clear polycarbonate.
D. Provide with battery operated warning horn.
E. For flush or surface mount devices.
F. Provide with weather gasket.
G. Spacers for additional depth as required.
H. Provide with tamper proof screws.
I. Design criteria:
   1. Safety Technology International, Inc. #1100 Series.

2.22 DOOR HOLDERS

A. Electromagnetic door holder/releases shall be installed on each door as detailed on the drawings and/or as specified herein. Holder/releases shall consist of wall mounted and floor mounted electromagnets and a door mounted armature with an adjustable contact plate. Electromagnets shall have a force of attraction of 24 pounds when energized and less than 3 pounds residual power disconnected. Armature contact plates shall have a horizontal adjustment of 25-degrees. The holding force of holder/releases shall be totally electromagnetic and without the use of mechanical linkage or other moving parts, and they shall normally be energized, and a release accomplished, by interrupting the circuit. Electromagnetic holder/releases shall be controlled by either automatic or manual alarm. Operating voltage shall be 24-volt DC.
B. Electromagnetic door holder/releases, where required, to be supplied and installed by the Contractor and wired into fire alarm system by systems contractor. Electromagnetic holder/releases shall be controlled by either automatic or manual alarm. Operating voltage shall be 24-volt DC.

2.23 SURGE SUPPRESSION

A. Non-Addressable Initiation Devices:
   1. Plug-in replacement modular design with associated female wiring connector.
   2. UL 497B listed and labeled.
   3. Multi-stage hybrid protection circuit.
   4. Fail short/fail safe.

5. Surge Capacity: 10KA with 8 x 20s waveform, 500A per line with 10 x 700s waveform.
6. Clamp Voltage: 150% of circuit peak operating voltage with 100 amp 10 x 700s waveform.
7. Maximum Continuous Operating Voltage: 125% of peak operating voltage, minimum.
8. Capacitance: 1500 pf.
9. Manufacturer:
    a. EDCO #PC642C series with #PCBIB base.

B. Addressable Initiation Devices and Data Loops:
1. Plug-in replacement modular design with associated female wiring connector.
2. UL 497B listed and labeled.
3. Multi-stage hybrid protection circuit.
4. Fail short/fail safe.
5. Surge Capacity: 10KA with 8 x 20s waveform, 500A per line with 10 x 700s waveform.
6. Clamp Voltage: 150% of circuit peak operating voltage with 100 amp 10 x 700s waveform.
7. Maximum Continuous Operating Voltage: 125% of peak operating voltage, minimum.
8. Capacitance: 50 pf.
9. Manufacturer:
    a. EDCO #PC642C-LC series with #PCBIB base.

C. Horn, Strobe, Control Power (Low Voltage):
1. Plug-in replacement modular design with associated female wiring connector.
2. UL 497B listed and labeled.
3. Multi-stage hybrid protection circuit.
4. Fail short/fail safe.
5. Surge Capacity: 5KA with 8 x 20s waveform.
6. Clamp Voltage: 150% of circuit peak operating voltage with 100-amp 10 x 700s waveform.
7. Maximum Continuous Operating Voltage: 125% of peak operating voltage, minimum.
8. Series Resistance: 0.2 ohms total per pair.
9. Manufacturer:
    a. EDCO #P164 series (1 pair); #P264 series (2 pair), each with #SD12-PC base.

D. Power Circuit (120 volt):
1. UL 1449 listed.
2. 15 amp, 120V rated.
3. Suppressors shall be tested per IEEE, C62.41-1991 for Categories A and B.
4. Normal mode (L-N), and common mode (L+N-G) protection.
5. Internal fusing.
6. Hybrid design.
7. Indicators for normal operation and failure indication.
8. Enclosure:
    a. Fire retardant high impact, phenolic or plastic housing or metal enclosure.
9. Clamping voltage UL 1449, Line to Neutral, Category B Impulse At (3KA, 8 x 20s): 385V @ 120V.

10. Maximum Surge Capacity: 20,000 amps.
11. Maximum Continuous Operating Voltage: 115% of line voltage.
12. Provide hardwire connection or add 15-amp receptacle device to hardwired devices to match equipment being protected and maintain UL listing.
13. Provide additional 15 amp in-line fusing as required to comply with UL and the NEC when connected to a 20 amp, 120V circuit.
14. Manufacturers:
    a. Leviton #51020-WM (hardwired).
    b. EDCO #HSP-121BL2.

E. Terminations
1. Provide terminals sized for circuits required on project.
2. Where surge suppression modules are for mounting on 'M' block assembly, provide M block assembly complete with grounding system that mates with surge suppression equipment.

F. Terminal Cabinets
1. Provide terminal cabinets for all terminations and surge suppression equipment including 120VAC power surge suppressor as required in Section Surge Protection Devices. Size terminal cabinets as required to facilitate installation of terminations and surge suppression in a neat and workmanlike manner.
2. Terminal cabinet to meet specifications in Section Cabinets and Enclosures unless specifically manufactured for use.
3. Manufacturers:
    a. Interior.
        i. Square "D"
        ii. Hoffman
        iii. BUD
    b. Exterior.
        i. Hoffman
        ii. BUD
        iii. Carlon.

2.24 CABLE

A. Contractor shall provide and install cable as required by the manufacturer, as specified elsewhere in these specifications, and to provide a complete, fully operational, UL Listed Fire Alarm system.

B. Fire alarm system cables installed in interior, exterior and/or underground raceways shall comply with the applicable sections of NEC Articles 760, 770 and 800.

C. Zip and zip type cables (e.g., West Penn 970, 971, 972, 974 or similarly constructed cables from other manufacturers) shall not be acceptable.

D. Wiring color code shall be as follows:

1.	Horns/Strobes	Black/Red
2.	Door Holders	White
3.	A.H.S.D.	Purple
4.	Gas Shut-Off Pull Stations	Orange
5.	Addressable	Twisted Pair Data Wire

6.	Hard-Wired	Brown/Blue
7.	Speaker	Twisted Pair Audio Wire

2.25 WATERFLOW DETECTOR

A. Water flow switch to be supplied and installed by the mechanical contractor and wired into Fire Alarm System by systems contractor. Zone as shown on zone schedule.

2.26 SPRINKLER SUPERVISORY SWITCHES

A. Supervisory Switch to be supplied and installed by mechanical contractor and wired into Fire Alarm System by systems contractor. Zone as shown on zone schedule.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Contractor is advised that circuit routing for this system is not necessarily shown on the project drawings. The contractor shall provide and install all raceways, wiring and cabling required for a complete and fully functional system as intended by these specifications. All wiring and/or cabling shall be in conduit. Contractor shall provide and install a properly sized, flush mounted outlet box for every device. Contractor shall size and route raceways to accommodate the proper installation of the system cabling. T-Tapped cabling shall not be acceptable. In locations where raceway and/or conduit is not accessible after completion of the project, conduit shall be routed from device to device or fire rated access panels shall be installed to provide access to junction and pull boxes. Routing of raceway from device to device shall only be acceptable where the wiring scheme of the system, as recommended by the manufacturer, requires cable to pass from device to device. Contractor shall properly terminate each device according to the manufacturer’s recommendations. Firestopping where penetrations are made through rated walls and floors shall be required. Firestopping is to be performed under Division 7 Section Firestopping.

B. Locate, install, and test fire alarm and detection systems in accordance with the equipment manufacturer's written instructions, and the latest editions of the National Electrical Code, the National Electrical Contractors Association publication "Standard of Installation" and all applicable codes and standards referenced in this specification.

C. Provide all work required for a complete system including complete system testing and checkout. All components shall be properly mounted and wired. The installation of this system shall comply with the directions and recommendations of authorized factory representatives.

D. Provide wiring, cabling, raceways, and electrical boxes in accordance with manufacturer's written instructions.

E. Components shall be electrically "burned-in" by operating the component at full power for a period as recommended by the manufacturer.

F. Installation shall be done in a neat workmanlike fashion by a firm regularly engaged in Fire Alarm Installation and Service.

G. The installation and inspection of all fire detection and fire alarm devices and systems shall be performed by, or under the direct on-site supervision of, a licensed fire alarm technician or a fire alarm planning superintendent who shall certify the work upon completion of the activity. The certifying licensee shall be present for the final test prior to certification.

H. As-built plans and wiring diagrams shall bear the signature and license number of the licensed fire alarm planning superintendent, the date of installation and the name, address, and certificate-of- registration number of the registered firm.

I. All components shall be completely wired. System shall be fully operable when main power service has failed, and the Emergency Standby Generator has assumed emergency system loads. This shall require that any devices which required 120-volt power shall receive supply from an emergency 120-volt source.

J. Installation of detectors:

1. All ceiling mounted detectors shall be installed in accordance with the requirements of NFPA 72.
2. All concealed detectors shall be provided with a remote indicating lamp and test switch installed in an occupied space (corridor, etc.) on wall or on the ceiling grid indicating the type of detector and the zone to which it is connected. Label shall be red with white lettering.
3. Duct detectors shall be installed in accordance with NFPA 90A. All brackets and hardware shall be provided as required to install detector housing in correct position. All detector housings shall be sealed as required to prevent air leakage between duct and housing. Sampling tubes of proper length shall be provided and installed to match duct width at the installed location.

3.2 RACEWAYS AND BOXES

A. Provide dedicated raceway with applicable boxes for all fire alarm wiring in accordance with applicable sections of these specifications.

B. All initiating, indicating and auxiliary control devices shall be mounted on UL listed outlet boxes.

C. Provide supporting devices per Section Conduit.

D. Identify raceways and boxes per Section Identification for Electrical Systems.

3.3 WIRE/CABLE

A. Conductor: 98% conductivity, stranded copper with maximum of 19 strands. Stranded conductors shall have a compression lug installed at every end. Wrapping twisted strands at terminal block screw is not acceptable. As an acceptable equivalent, stranded conductor without crimp-on lugs may be terminated into terminal strips of box-lug connectors. SLC loops may utilize solid conductors.

B. Insulation: A type accepted by NEC for the application. All cable shall be UL listed for fire-protective signaling application. Communication, Class 3 or Multi-Purpose cables shall not be substituted for FP cable types. All multi-conductor cables shall have individually insulated conductors with an overall outer jacket.

C. Size: All conductors shall be sized as prescribed by the system manufacturer, with following minimums:

1. Multiplex Signaling Line Circuit: AWG #14, solid twisted pair.
2. Notification Circuits, Devices: AWG #14 THHN/THWN stranded conductors.
3. Initiating Circuits, Hard-Wired Devices: AWG #14 THHN/THWN stranded conductors.
4. Initiating Circuits, Addressable Devices: AWG #16 twisted pair.
5. Speaker Notification Circuits: AWG #16 twisted pair.
6. Provide larger conductors where required to maintain voltage drop or signal strength within acceptable limits.
7. Multiplex signal line circuits and addressable circuits shall be either shielded or unshielded based on equipment manufacturer’s recommendations for specific application.

D. The above wire sizes shall be increased to size as required to comply with Authority Having Jurisdiction or as required for voltage drop, load, etc.

E. Color Coded:

1. Wiring shall be color coded as required to match existing system.
2. Permanent wire materials shall be used to identify all splices and terminations for each circuit at all junction boxes, outlet boxes, and terminations.

F. UL:

1. General: Fire-protective signaling cable shall be UL listed as non-power limited or power limited as needed to match the output of the fire alarm equipment.
2. Non-Power Limited: Fire protective signaling circuits classified as non-power limited shall use cable listed under UL Electrical Construction Materials Directory. Category HNHT, "NON-POWER LIMITED FIRE-PROTECTIVE SIGNALING CABLE". All such cable shall have fire resistance, listing and markings as described in NEC 760.176. Minimum cable marking shall be NPLF.
3. Power Limited: Fire protective signaling circuits classified as power limited shall use cable listed under UL Category HNIR, "POWER LIMITED FIRE-PROTECTIVE SIGNALING CABLE". All such circuits shall be durably marked where plainly visible at terminations to indicate that it is a power-limited fire protective signaling circuit. Refer to paragraph titled "Fire Resistance of Cables" for additional requirements.
4. Fire Resistance of Cables: Power-limited fire-protective signaling circuit cables shall be UL listed as described in NEC 760.179. All such cable shall bear a cable marking that includes a Type designation as given in NEC 760.179(I). Provide Type FPL.

G. Connections of Installation Wiring:

1. Connections to Equipment: In accordance with NFPA for monitoring integrity and with the equipment manufacturer's instructions.
2. Connections of installation wiring to alarm initiating devices and alarm indicating appliances shall be monitored for integrity.
3. Interconnecting means shall be arranged so that a single break or single ground fault will not cause an alarm signal.
4. Apply a compression lug, similar to T&B Sta-Kon Terminal, to all stranded conductors at terminations or use box-lug terminal strips.
5. There shall be no wire splices. All wiring shall be continuous, uncut between devices and terminal blocks.

H. Rated Enclosures:

1. All vertical fire alarm wiring traversing more than one level shall be routed in rated enclosures. In addition, all horizontal wiring serving devices located on floors other than where wiring originates shall be routed in 2 inch concrete encasement, suitable rated building construction, or 2 hour wrap application enclosure accepted by local Authority Having Jurisdiction.

3.4 MANUAL PULL STATIONS

A. Install at 48 inches to top above finished floor.

B. All manual stations shall be in unobstructed locations.

C. Install to comply with NFPA, ADA, and all handicap/accessibility code requirements.

D. Provide, install, and connect additional pull stations (from that shown on drawings) as required to comply with above requirements.

3.5 AUDIBLE SIGNAL DEVICES, VISUAL SIGNAL DEVICES, COMBINATION AUDIBLE/VISUAL SIGNAL DEVICES

A. Shall comply with NFPA, the Americans with Disabilities Act and other applicable handicap/accessibility codes including but not limited to the following:

1. Wall mounted devices shall have their bottom edge at heights above the finished floor of not less than 80 inches and no greater than 96 inches.
2. In general, no place in any room or space required to have a visual signal appliance shall be more than 50 feet from the signal (in the horizontal plane). In large rooms and spaces

exceeding 100 feet across, without obstructions 6 feet above the finished floor, such as auditoriums, devices may be placed around the perimeter, spaced a maximum 100 feet apart, in lieu of suspending appliances from the ceiling. Placement of visual devices shall not be less than the requirements as specified by NFPA 72.

3. No place in common corridors or hallways in which visual alarm signaling appliances are required shall be more than 50 feet from the signal. Placement of visual devices shall not be less than the requirements as specified by NFPA 72.

3.6 END-OF-LINE DEVICE

A. Mount end-of-line device box with last device or separate box adjacent to last device in circuit.

3.7 AUXILIARY CONTROL RELAYS

A. An auxiliary fire alarm relay used to control an emergency control device, e.g. motor controller for HVAC system fan or elevator controller shall be located within 3 feet of the emergency control device.

B. The installation wiring between the system panel and the auxiliary fire alarm relay shall be monitored for integrity.

C. Auxiliary control relays shall be listed for use with fire alarm systems.

3.8 SPRINKLER FLOW SWITCHES

A. Coordinate the electrical and operating characteristics of the flow switches with the fire alarm panel.

B. Run conduit and wiring to the flow switches and connect them so as to provide an operable supervised sprinkler alarm system per NFPA standards, and state and local codes.

C. Provide all electrical including zones as required by Authority Having Jurisdiction and codes.

3.9 SPRINKLER VALVE SUPERVISORY SWITCHES

A. Coordinate the electrical and operating characteristics of the supervisory switches with the fire alarm panel.

B. Run conduit and wiring to the supervisory switches and connect them so as to provide an operable supervised sprinkler alarm system per NFPA standards, and state and local codes.

C. Provide all electrical including zones as required by Authority Having Jurisdiction and codes.

3.10 DOOR ELECTRIC LOCK AND HOLD-OPEN POWER SYSTEMS

A. General: Provide 24V-dc low voltage power to all building doors with openers, hold-open devices, closers, or electric locks. Refer to Architectural door hardware schedule for doors that may have electric holders or locks. Low voltage power supplies for door hardware shall be furnished separately from the fire alarm system. The fire alarm system shall only provide the unlocking or release control signals and auxiliary control relays at power supplies, in order to reduce power draw on fire alarm system power supplies and batteries.

B. Low Voltage Power: Provide a low voltage transformer on each floor having doors with electric hardware. Transformer shall be 120-24V ac, sized as required to handle load served. Mount in a NEMA 1 enclosure above accessible corridor ceiling outside the first door closest to fire alarm riser. Provide transformer primary fusing to comply with N.E.C. Provide a 24V ac-24V dc rectifier on the secondary side of the transformer. Provide dedicated branch circuit from closest 120V normal power panel. Provide necessary interposing auxiliary control relay(s) to accept unlocking/release and restore signals from the fire alarm system.

C. Wiring: Electric hardware shall be connected for fail-safe operation. Upon loss of normal power hardware shall unlock without unlatching. Hold-open doors shall release for closure. Restoration of hardware power shall be automatic after the fire alarm system unlock control is reset. Provide all wiring necessary to connect transformer. Provide all low voltage wiring to connect electric locks. Extend wiring down hinge side of stair door jamb through hinge plate into door and through door to electric lock mechanism.

D. Fire Alarm Unlocking Control: All door hardware circuits shall be controlled by fire alarm system. Upon receipt of signal from fire alarm system all door holders shall release, and stair/egress door electric locks power system shall be disabled allowing all locks to unlock (without unlatching). Signal to activate shall be automatic fire alarm signal or manual command initiated in the building Fire Control Room. Manual unlock override command shall be through override system. Reference paragraph entitled "FIRE DEPARTMENT OVERRIDE CONTROL PANEL". Provide pilot light and 3-position override switch. ON position (illuminated red pilot light) shall initiate fail-safe operation. OFF position shall restore low voltage power. Provide separate override switch for door openers associated with Atrium Smoke Exhaust System.

E. Mount outlet box for electric door holder to withstand 80 pounds pulling force.

3.11 GAS/FUEL SHUT-OFFS

A. Whether shown on drawings or not provide gas/fuel shut-off systems for each and every gas/fuel supply as required by the applicable codes and standards.

3.12 ELEVATORS

A. Operation of elevators under fire or other emergency conditions - elevators having a travel distance of 25 feet or more shall conform to the requirements of ANSI A17.1, Safety Code for Elevators and Escalators, Rule 2.27.3, as incorporated herein by reference.

B. When an automatic sprinkler system is required to be installed throughout a building for complete fire protection coverage, the provisions of ANSI A17.1, Rule 2.8.2, which is incorporated herein by reference, shall be applicable. When an automatic sprinkler system is required to be installed, the automatic sprinkler system shall be a pre-action sprinkler system and the pre-action sprinkler shall be installed in the elevator machine room and elevator hoist way. An accepted fixed temperature (135-degrees F.) heat detector shall be installed in the elevator machine room, elevator pit, and elevator hoist way as an integral part of the pre-action sprinkler system to automatically disconnect the main power supply to the affected elevator(s) prior to the application of water. The main power supply shall not be self-resetting. The activation of sprinklers outside of the hoist way or machine room shall not disconnect the main power supply. The sprinkler head located in the elevator machine room and elevator hoist way shall have an activation temperature greater than the accepted fixed temperature heat detector.

C. In addition to the requirements of ANSI A17.1, Rule 2.27.3.2.1, an accepted smoke detector(s) shall be installed in the elevator hoist way, and the machine room meeting the requirements of Rule 69A-47.008. The activation of the smoke detector(s) in the machine room or the elevator hoist way shall cause a suitable warning light to flash. The light is to be located adjacent to the "phase one" recall switch required by ANSI A17.1 Rule 2.27.3.1 (2016) or elevator hall button. The warning light shall be red, and a minimum diameter of 1/8 inch. A sign shall be incorporated with or adjacent to the light and contain the following wording "DO NOT USE ELEVATOR". The minimum size for the letters on the sign shall be 1/8 inch. Provide supervised fire alarm system wiring and power to elevator warning lights. Lights shall function per elevator bank. Provide and install light at first floor and alternate floor as directed by Authority Having Jurisdiction.

D. Provide detectors with auxiliary relay complete with tie into elevator controller as required by all codes or provide separate zone.

3.13 CABLE IDENTIFICATION

A. Provide and install permanent cable markers on all cables/wire lines, telephone lines, etc. at terminal strips, terminal cabinets and at main equipment.

3.14 SURGE PROTECTION

A. General

1. Provide, install and connect new surge suppression equipment as specified herein, including protection of equipment power source, cable/wire entering or leaving building housing, main fire alarm system equipment, ground lugs, #6 copper ground wire in 3/4 inch c. to existing main building service ground.

2. Extreme care shall be taken by contractor to assure a properly surge protected system.
3. Surge protection equipment must be selected by contractor to match the equipment being protected including wire sizes, operating volts, amps, and circuit impedance.
4. Installation of surge protection equipment and its grounding must be per manufacturer's recommendations to assure short and proper ground paths.

B. Equipment Selection
1. Contractor to coordinate with suppliers and installers of all equipment being protected and provide surge suppression equipment which meets these specifications on respective equipment, wires, etc.

C. Equipment Installation
1. Install surge suppression equipment per manufacturer’s recommendation at each wire terminal as noted under Part 1.
2. Install in surge suppression equipment terminal cabinets, etc. as required to facilitate installation of surge protection equipment and terminal points. Increase size of terminal cabinets (from that shown on drawings) to size required to facilitate installation of surge suppression equipment and terminal blocks.
3. Locate surge suppression equipment in terminal cabinet nearest main equipment cabinet (FACP).
4. Coordinate with Section Surge Suppression Equipment Contractor to assure that surge suppression for 120VAC power circuit and surge suppression required by this section are all installed in same terminal cabinet and bonded together.

D. Ground Installation
1. Ground Bus Connections.
    a. Provide "local" ground bus in each terminal cabinet housing surge protection equipment (with lugs, etc. as required).
    b. Bond "local" ground bus to terminal cabinet with minimum #6 copper wire.
    c. Connect terminal cabinet "local" ground bus to "systems" ground bus installed per Section Grounding and Bonding with minimum #6 copper insulated wire (unless otherwise noted) in conduit.
    d. Note that "systems" ground bar is also to be used for power transformation ground (480V to 208V) where applicable.
2. Surge suppression equipment grounding.
    a. Connect each surge suppressor to local ground bus in terminal cabinet with wire sized as recommended by manufacturer. Where "M" block type terminations/surge suppressors are used, bond ground rail to local ground bar with wire as recommended by manufacturer.
    b. Coordinate with Section Surge Protection Devices Contractor to assure that 120VAC power source/supply surge suppressor is also grounded to same local ground bus as surge suppressors provided in this section for same system (i.e., fire alarm, intercom, television, etc.).
3. Conductors.
    a. Conductors shall meet requirements of Section Building Wire and Cable. Minimum size to be #12 THWN.
    b. Bends in excess of 90 degrees in any grounding conductor shall not be permitted. A radius of 6 inches or greater shall be maintained on all bends.
    c. Do not bundle unprotected conductors with protected conductors.

d. Conductors shall be kept as short as possible.

e. Conductors shall be secured at 12 inches intervals with an accepted copper clamp.

f. Grounding conductors shall be properly connected to the building service ground by accepted clamps.

4. Grounding Connectors

a. Connectors, splices, and other fittings used to interconnect grounding conductors, bond to equipment or grounding bars, shall be accepted by NEC or UL for the purpose.

b. All connectors and fittings shall be of the Nicopress crimp or compression set screw type.

c. Special treatment to fittings, lugs, or other connectors of dissimilar material shall be applied to prevent electro-galvanic action.

3.15 CONDUIT/BOX IDENTIFICATION

A. Contractor shall identify fire alarm conduit and boxes with red paint in exposed locations. Identify conduit in concealed locations with 4" mark of red paint every 4'-0" OC.

3.16 DEMONSTRATION

A. When system is complete it shall be demonstrated to Owner's Representative who shall be given complete instructions, spare parts, manuals and maintenance information.

3.17 SYSTEM TESTING

A. Prior to certification of the fire alarm system the contractor shall accomplish a complete test of the fire alarm system in accordance with NFPA 72, Test Methods.

B. Perform a complete, functional component by component test of the entire fire alarm and detection system. Provide a detailed step by step testing procedure which is unique to this project, reflecting the type of system and the number and location of all components.

C. Perform a sensitivity test of all smoke detectors and duct detectors. Perform a calibration/test of heat sensors.

D. Demonstrate the proper operation of each component as follows:

1. Photoelectric, and duct smoke detectors: activate the detector with a "false smoke" product which has been specifically formulated for testing smoke detection systems.

2. Heat detectors: activate the detector by utilizing the detector check button.

3. Pull Stations: activate the station by operating the station in its normal mode.

4. Audible, Speaker, and Visual Alarms: verify proper operation when the system is put into the alarm mode.

5. Sprinkler Flow Switches: open the sprinkler system's inspection test valve. Verify that the flow switch sends an alarm signal within the allowed time corresponding to the switch's time delay setting.

6. Fire Alarm Panels: functionally check-out and test the panel per the manufacturer's written instructions. Demonstrate the proper operation of each modular component. Demonstrate automatic power change to batteries and back to building power upon a drop in voltage below the voltage threshold as specified by the panel manufacturer.

E. Demonstrate the supervisory function at each device loop circuit, and at all single component wiring runs such as for the sprinkler valve supervisory switches.

3.18 CERTIFICATION

A. After completion of the installation of the system, the licensee shall complete a NFPA Inspection and Testing form. The Inspection and Testing form format shall be as indicated in NFPA 72,

Inspection and Testing Form. When an Inspection and Testing form has been completed, legible copies shall be distributed as directed by the Authority Having Jurisdiction.

B. After completion of the installation and testing provide NFPA 72, Record of Completion Form to the Owner.

C. After an installation has been complete, affix a Fire Alarm Tag to the control panel. The Fire Alarm Tag is in addition to the Inspection and Testing form. Protect the Fire Alarm Tag from vandalism by applying pressure sensitive label; do not use a "tie-on" tag. It shall be as required in the Fire Safety Rules.

3.19 FINAL DRAWINGS

A. As-built drawings shall be given to the Owner’s representative, at time of instruction, in addition to those to be supplied as general requirements of the job.

3.20 AUTHORITY HAVING JURISDICTION

A. The drawings and specifications herein comply to the best of the Engineer's knowledge with all applicable codes at time of design. However, it is this Contractor's responsibility to coordinate/verify (prior to bid) the requirements of the Authority Having Jurisdiction over this project and bring any discrepancies to the Engineer's attention at least 7 days prior to bid. No changes in contract cost will be acceptable after the bid for work/equipment required to comply with the Authority Having Jurisdiction.

END OF SECTION

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SECTION 31 10 00 - SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SCOPE

A. The work consists of furnishing all labor and equipment necessary for the removal of trees, vegetation, above and below grade improvements, and waste materials from designated areas of the site.

1.3 DESCRIPTION OF WORK

A. Site clearing shall be performed as designated on the Drawings.

B. Site clearing work includes, but is not limited to:

1. Removal of trees
2. Removal of grass and other vegetation
3. Topsoil stripping
4. Grubbing
5. Removal of above grade improvements
6. Removal of below grade improvements
7. Proof-Rolling

1.4 JOB CONDITIONS

A. Traffic: Conduct site clearing operations to ensure minimum interference with roads and other adjacent facilities. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction.

B. Protection of Existing Improvements: Provide protection necessary to prevent damage to existing improvements indicated to remain in place.

C. Protect improvements on adjoining properties and within public rights-of-way.

D. Restore damaged improvements to their original condition, as acceptable to parties having jurisdiction.

E. Protection of Existing Trees and Vegetation: Protect existing trees and other vegetation against unnecessary cutting, breaking or skinning of roots, skinning and bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line. Provide temporary guards to protect trees and vegetation to be left standing.

1. Provide protection for roots over 1" diameter cut during construction operations. Coat cut faces with emulsified asphalt, or other acceptable coating, formulated for use on damaged plant tissues.
2. Temporarily cover exposed roots with wet burlap to prevent roots from drying out; cover with earth as soon as possible.
3. Replace trees which cannot be repaired and restored to full-growth status, as determined by arborist, in a manner acceptable to the Owner.

PART 2 - PRODUCTS (NOT USED)

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PART 3 – EXECUTION

3.1 SITE CLEARING

A. Carefully and cleanly cut roots and branches of trees where such roots and branches obstruct new construction.

B. Clearing and Grubbing: Clear site of trees, shrubs, grass and other vegetation in accordance with the construction plans. All trees identified to remain shall be protected in accordance with Part 1.4.E. After stripping, the site shall be grubbed such that roots with a diameter of a ½ inch or greater and stumps are completely removed. The depth of the stripping and grubbing shall be determined by on-site visual inspection by the Geotechnical Field Technician.

C. Completely remove stumps, roots, and other debris.

D. Use only hand methods for grubbing inside drip line of trees on adjacent properties.

E. Proof-rolling: Upon completion of the clearing and grubbing operations, the Contractor shall perform proof-rolling operations over the site. Proof-rolling shall be performed using a self-propelled compactor that will provide a density of 95% of the modified Proctor for the top two feet of in place soils. Contractor shall have the Testing Agency available to visually inspect the proof-rolling activities and to identify areas of soft or unsuitable soils near the surface. The recommendations of the Sub-surface Soil Exploration and Geotechnical Engineering Evaluation shall be a requirement of this activity. The use of vibratory compaction is prohibited.

F. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.

G. Place fill material in horizontal layers not exceeding 6" loose depth, and thoroughly compact to a density equal to adjacent original ground.

3.2 REMOVAL OF IMPROVEMENTS

A. Remove above-grade and below-grade improvements necessary to permit construction and other work indicated.

B. The Contractor is advised that uncharted utilities may be found to exist within the construction areas and should perform clearing and grubbing operations with extreme caution.

1. Should the Contractor discover any unforeseen site conditions that conflict with the information provided or would in any way prevent construction the improvements indicated on the construction drawings, the Contractor shall notify the Architect immediately, in writing, as to the nature of the conflict or discrepancy. The Architect, or his representative, will expeditiously investigate the discrepancy for a determination of the impact to the Contract.

2. No claim by the Contractor will be allowed if the Contractor fails to provide such written notice.

3.3 DISPOSAL OF WASTE MATERIALS

A. Burning on Owner's Property: On-site burning of waste material is not allowed unless written MCPS approval is obtained.

B. Removal from Owner's Property: Remove waste materials, unsuitable spoil material, and excess topsoil from Owner's property and dispose of off site in legal manner. It is the Contractor’s responsibility to obtain any and all necessary permits for site clearing operations, and for the transportation and disposal of waste materials, including the cost of the permits.

END OF SECTION

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SECTION 31 20 00 - EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.2 DESCRIPTION

A. Earthwork shall include, but not be limited to:

1. Import or export of any and all material as required to fill and complete grading and site work.
2. Excavation, backfilling and compaction for structures, and appurtenances and any related groundwater control and dewatering. All dewatering shall be the responsibility of the Contractor. See Specification Section 31 23 19, Dewatering.
3. Excavation, shoring, trenching, backfilling, bedding and any dewatering required for utility and other underground lines and appurtenances installed by this Contractor. Particular attention is called to the requirement that no intrusion upon or disturbance of adjacent properties will be allowed.
4. Final grading, shaping and compaction of site and roadways after the mass grading and earthwork is complete.
5. Removal of all materials not to be incorporated into the work.

B. Related Work Specified Elsewhere:

1. Section 31 10 00, Site Clearing
2. Section 31 23 19, Dewatering
3. Section 32 12 16, Asphalt Paving
4. Section 32 13 13, Concrete Paving
5. Section 33 11 00, Water Utility Distribution Piping
6. Section 33 31 00, Sanitary Utility Sewerage Piping
7. Section 33 41 00, Storm Utility Drainage Piping
8. Soils Investigation: Geotechnical Soils Investigation performed for the project.

1.3 QUALITY ASSURANCE

A. Testing Agency: In addition to complying with all other requirements specified in this section, refer to and comply with testing requirements identified elsewhere in the Contract Documents.

1. Prior to the execution of any earthwork operations, the Testing Agency shall be notified to review procedures and assist in the proper implementation of these Specifications. All earthwork preparation, compaction and testing shall be done under the supervision of the Testing Agency or his representative.
2. Prior to the execution of earthwork, the Construction Manager shall be instructed to coordinate all earthwork with both the Geotechnical Engineer and the Testing Laboratory.

B. Reference Specifications and Standards:

1. ASTM: D2922 (Nuclear Method), or ASTM D1556 (Sand-Cone Method) or ASTM D2937 (Drive Sleeve Method).
2. ASTM: D3017 (Nuclear Method), or ASTM D1557 Moisture Density Relations of Soils, using 10-1b, Rammer and 18-in. Drop.
3. AASHTO T-180.

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1.4 PROJECT CONDITIONS

A. Locate existing underground utilities in and adjacent to the area of work. If utilities are to remain in place, provide adequate means of protection during earthwork operations.

B. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult with the utility owner immediately for directions. Cooperate with utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.

C. Do not interrupt existing utilities except when permitted in writing by the Owner and then only after acceptable temporary utility services have been provided.

D. Protect structures, utilities, sidewalks, pavements and other facilities in or adjacent to the area of work from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations. Refer also to Article 3.2, Protection, for additional requirements.

E. Use of Explosives:

1. The use of explosives is not permitted.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS FOR STRUCTURES AND SITE GRADING

A. On-site materials: This section is related to materials obtained by selective stockpiling of the on-site excavated soils. All materials shall be stockpiled as directed by the Testing Service which shall be present during all excavation activities. Only materials identified as acceptable to the Geotechnical Engineer and the Testing Service will be considered. Refer to the soils report for materials that may be considered acceptable. All materials that have been tested and deemed to meet the quality required by the soils report shall be presented to the project engineer for final acceptance prior to placement on the site.

B. Borrow materials: Non-expansive clean earth and granular materials, with less than 10% passing No. 200 sieve and free of roots, debris, clay or organic materials. Do not use rocks or lumps larger than 3 inches in any dimension.

C. Crushed Stone: Crushed stone shall be provided by the Contractor from off-site sources and in the quantities required for completion of the work and of the quality specified and approved. Crushed stone shall consist of washed clean, hard, durable, angular pieces and shall be satisfactorily free from loam, clay, fine sand, lime, crushed concrete, and deleterious materials. Crushed stone shall be uniformly graded and range in sizes from 1 inch to 3/8 inch and conforming to ASTM D693, Size No. 57.

D. Top Soil: All soil above the lower root line of fine vegetation (grasses and sod).

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions under which earthwork is to be performed and promptly notify the Architect in writing, of conditions detrimental to the proper and timely completion of work. Do not proceed with the work until unsatisfactory conditions have been corrected in an acceptable manner.

3.2 PROTECTION

A. Protect public and adjacent properties, on and off site, in accord with applicable laws and ordinances.

B. Protect from damage all existing on-site features, scheduled or indicated to remain, including flora scheduled to remain.

C. Utilities:

1. Remove uncharted utility lines or lines found to be abandoned that are encountered during excavation and dispose of off site.

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2. Open trenches: The Contractor shall comply with the provisions of the Trench Safety Act, Chapter 90-96, Laws of Florida and with the O.S.H.A. Safety Standards, 29 C.F.R., S. 1926.650, Subpart B. Cover or barricade all open trenches at the close of the work day.

3.. Where excavation for utility lines occurs in the vicinity of existing utilities, whether indicated or not, the Contractor shall be responsible to maintain the existing utility service and to protect and support the utility line in a manner to prevent its damage or failure.

a. In the event that damage or failure does occur, immediate repair and replacement shall be made in an acceptable manner as part of the work of this Section.

D. Dust Control:

1. Throughout the entire construction period effectively control dust in work areas, whether on-site or off-site, to prevent adversely affecting adjacent properties.

E. Water Control:

1. Do not allow rain, surface or sub-surface water, or other fluid, to accumulate in excavations nor under or about buildings, manholes, catch basins, tanks, vaults, etc.

2. Should such conditions develop or be encountered, constantly control and legally dispose of the water by temporary pumps, piping, ditches, dewatering or other approved methods. All methods subject to Architect's review and approval.

a. Do not allow rain or surface water from construction areas to run off or contaminate areas beyond the limits of the site.

b. Maintain adequate pumping equipment and backup equipment on hand at all times to provide for emergencies.

F. Bracing, Cribbing and Shoring:

1. Provide temporary or permanent cribbing, sheeting and shoring as necessary to safely retain earth banks and protect excavations from saving or other damage.

2. Remove cribbing and shoring after use. When or where it is impractical to remove, obtain approval to leave it in place. Note locations of such in-place shoring and bracing on project record documents.

G. Environmental Protection:

1. Erosion Control and Maintenance:

a. The Contractor shall furnish and install erosion/sediment control fencing prior to the beginning of earthwork activities. Said fencing shall be constructed of erosion control fabric with both sediment filtration capabilities and a high slurry flow rate. All fencing to be installed as indicated on the Drawings.

b. Swales and retention ponds shall be provided as necessary to control surface drainage during construction.

c. Erosion control features shall be repaired as required and maintained until such time as the Architect deems them unnecessary.

3.3 PREPARATION

A. Layout work and Reference Points:

1. Before starting layout work, check through and verify all principal governing dimensions and make a general check of elevations and grades called for on the drawings.

2. Locate benchmarks, monuments and other reference points for elevation and location of new work. Notify the Architect of any apparent discrepancies in indicated locations.

3. Protect reference points from dislocation or damage. Replace or repair immediately any points damaged, destroyed or dislocated.

4. Accurately locate new work on site according to the Contract Documents.

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5. Erect batter boards and set grade stakes securely to remain in place until corners and heights are permanently established.
6. Denote areas allocated for storage of various materials. Select storage and working areas to avoid interference with subsequent operations.

3.4 EXCAVATION

A. Excavation consists of removal and disposal of material of every nature encountered (including man-made objects) when establishing required grade elevations.

B. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions. General Unauthorized excavation, as well as remedial work directed by the Architect, and as recommended by the Testing Service, shall be at the Contractor's expense.

C. Additional Excavation:

1. When excavation has reached required subgrade elevations, notify the Architect and Testing Agency, who will make an inspection of conditions. Do not excavate below indicated depths.
2. If inspection indicates unsuitable materials, additional excavation and corrective work will be authorized and paid for as prescribed by the Contract Documents.

D. Excavation Requirements:

1. The subgrade under the proposed construction shall be stripped of vegetation, organic matter and/or soft and yielding materials. Stripping may be anticipated for a depth of up to 8-inches.
2. Proof-roll the site with a self-propelled roller with a minimum 10 ton static weight and 5-foot diameter drum. No vibratory compaction is allowed. Proof-rolling shall be performed in the presence of and as directed by a qualified representative of the Testing Agency.
3. Excavate materials of every nature to dimension, and elevations indicated. Use equipment of suitable type for materials and conditions involved.
4. Extend excavation a sufficient distance from structures to allow for forming and shoring, application of dampproofing, and approvals. Do not excavate below indicated depths.
5. Correct unauthorized excavation made below depths indicated, as directed by the Architect, at no additional cost to the Owner.
6. Remove any organic peat or inadequate soils below required subgrade elevation and replace with suitable fill according to Paragraph 3.6(B).
7. After the subgrade has been stripped and the areas have been excavated, the subgrade immediately beneath the proposed footings and structures shall be compacted to a minimum of 95% of the Modified Proctor maximum dry density for a depth of 24-inches.

3.5 DEWATERING (See 31 23 19)

A. All work areas occurring below the groundwater level shall be maintained in a dry condition while work is taking place at those elevations.

B. Dewatering methods shall be those selected by the Contractor. Method selected shall ensure that adjacent permanent ground water levels will be unaffected.

C. The Contractor shall be responsible for maintaining excavations and subgrades continuously while work in each area is being done. Water level shall be reduced to a level of 24 inches below the bottom of all excavations and compaction surfaces.

3.6 FILL, BACKFILL AND COMPACTION

A. Backfill consists of bedding, backfill and restoration of the surface.

B. Structures: (Buildings, manholes, catch basins, tanks, vaults, etc.)

1. Excavation and backfilling procedures beneath all structures shall be specified herein.

2. After excavation, remove any unsuitable or inadequate soils below required subgrade elevation, replace with suitable fill and compact in uniform maximum 12 inch lifts of clean granular fill to a minimum of 95% of the Modified Proctor maximum dry density for a depth of 24-inches below building foundations and 12-inches below areas to be paved.
3. Use mechanical compactors for compaction of backfill.
4. Place backfill as promptly as work permits, but only after walls are supported by completion of structure or are braced to resist the imposed loading.
    a. Place backfill against walls below grade after dampproofing systems have been completed and approved.
5. If approved by the Architect, hand held compaction equipment may be used. Maximum lifts in this case shall be 6 inches.

C. Compaction:
1. Bring each layer to optimum moisture content before compaction. Add water by uniform sprinkling. Jetting or flooding is prohibited.
2. When moisture content and condition of each layer is satisfactory, compact to not less than 95% of the Modified Proctor maximum dry density, or as elsewhere specified. (See 3.8.)
    a. Compact areas not accessible to motor-driven equipment with mechanical or heavy hand tampers.
3. Rework compacted areas failing to meet specified maximum density as determined by tests. Re-compact and re-test as required to achieve a minimum of 95% of the Modified Proctor maximum dry density.
4. Correct unauthorized excavation made below depth indicated, as acceptable to Test Agency, at no additional cost to Owner.
5. Landscape Areas: Compaction below all landscape, planting or sod areas shall be a minimum of 90% of the Modified Proctor maximum dry density for the full depth of fill. (See 3.8.)
6. Walks and site slabs-on-grade: Compaction below all walks and slabs shall be a minimum of 95% of the Modified Proctor maximum dry density for a depth of 24-inches. (See 3.8.)
7. Pavements: Compaction below all pavements shall be a minimum of 95% of the Modified Proctor maximum dry density for a depth of 12-inches below the bottom of the base course. (See 3.8.)
8. Testing Frequencies.
    a. Include the following minimum testing frequency requirements in the applicable sections(s) of the Project Specifications:
        1) In-place field density of natural ground and fill material – 1 test every 10,000 SF to a depth of 12” for natural ground and 1 test every 10,000 SF for each 12” lift of added fill material.
        2) Modified moisture density relationship (Protor) – 1 test for every material type.
        3) Sieve No. 200 wash – 1 test for every material type.
        4) Sieve No. 200 wash – Perform 3 tests during the course of construction of each playfield/ballfield. Test locations and depths shall be selected to demonstrate that the entire playing surface of all playfields/ballfields meets the specified fines content criteria for fill material.
        5) Organic content – 1 test for every material type.

3.7 GRADING

A. General:
1. Smooth finished surface within specified tolerances, compact with uniform levels of

slopes between points where elevations are shown, or between such points and existing grades.

2. Allowable tolerances for grades:

   a. All cuts and fills shall be graded to necessary subgrade elevations within a tolerance of 0.0 below to 0.10 feet above grades indicated on drawings.

   b. Structures at or on grade shall be within 0.02 feet.

3. All elevations and contours shown on the drawings are to finish grade unless otherwise indicated, and allowance shall be made for pavement thickness and sodding.

B. Grading outside building lines:

1. Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes.

C. Grading Surface of Fill Under Structure Slabs:

1. Grade smooth and even, free of voids, compacted as specified and to required elevation.

3.8 FIELD QUALITY CONTROL

A. Test Methods:

1. Maximum density of backfill materials will be determined by ASTM D1557 Method A (5-layer method), or AASHTO T-180 where called for on drawings.

2. Field tests will be determined by ASTM D2922 (Nuclear Method), or ASTM D-1556 (Sand-Cone Method) or AASHTO T238-79, or ASTM D 2937 (Drive Sleeve Method) unless other applicable method is approved.

B. Required Tests (to be performed by Testing Agency):

1. Backfill material: Determine suitability of backfill material not previously evaluated.

2. Maximum density tests: Determine optimum moisture content and maximum density of backfill materials placed and compacted.

3. Compaction Inspection: Determine degree of backfill compaction.

4. Bedding conditions: Determine and evaluate condition of bedding to receive utility lines.

C. Inspection and Controls (to be performed by Testing Agency):

1. General inspection of stripping of surfaces and removal of root mat, peat, clay and other unsuitable materials or conditions.

2. Detailed inspection of exposed subgrades prior to finishing or placing compacted fills.

3. Continuous control of placing and compacting all compacted fills.

4. Observation and consultation in processes of bank shaping, safety in excavations, dewatering and identification of materials encountered.

D. Areas which do not comply with the specified densities shall be reworked and compacted by the Contractor at no additional cost to the Owner. The cost of retesting such work shall be paid for by the Contractor.

3.9 DAMAGED WORK AND REPAIRS

A. Repairs:

1. Sections of walks, curbing, concrete paving and other permanent features which have been damaged during and as a result of construction operations in connection with the Contract shall be removed and the full section between joints shall be replaced.

B. Replacement of Grass and/or Shrubs:

1. All grass areas and/or shrubs which have been rutted and/or damaged or broken during and as a result of construction operations in connection with this Contract shall be removed and replaced. This shall apply to the grass and shrubs outside the Contract

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limits as shown on the site plan as well as new work within the Contract limits.

C. Protection of Graded Areas:

1. Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

2. Repair and re-establish grades in settled, eroded and rutted areas to specified tolerances.

D. Reconditioning Compacted Areas:

1. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape and compact to required density prior to further construction.

E. Debris:

1. During construction, debris shall be removed from site as soon as practical and the exterior site shall be kept clean at all times.

2. Debris shall be disposed of as waste material at an approved off-site disposal facility.

3.10 LAYOUT SURVEY AND RECORD DRAWINGS

A. Layout for all construction improvements, paved and surface areas other appurtenances to be constructed shall be performed by Contractor in strict accordance with drawings and work performed shall ensure true lines, angles and elevations. All angles, lines, grades, and elevations shall be thoroughly checked by Contractor.

B. Upon completion of placement of construction improvements, the Contractor shall provide Owner and Architect with complete and accurate Record Drawings performed by a surveyor registered in State of Florida. The drawings provided must be labeled “Record Drawings” and shall indicate exact horizontal and vertical location (relative to the project coordinate system and N.G.V.D.) of buildings, concrete and asphalt surfaces and all drainage features including lakes, retention/detention areas, berms, embankments and swales. All of the spot elevations shown on the paving and drainage plans shall be measured and the individual constructed grades shall be included on the Record Drawings. Additionally, where grading between any two elevations on the plan has not been constructed at a uniform slope, then sufficient information shall be included to provide a true representation of the constructed grading conditions.

C. In addition to the information outlined above, the Record Drawings shall include the calculated volume of all lakes and retention/detention areas constructed as part of the project. All elevations shown on the Record Drawings shall be accurate to the nearest hundredth of a foot.

END OF SECTION

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SECTION 31 23 19 - DEWATERING

PART 1 - GENERAL

1.1 SUMMARY

A. Dewatering consists of performing work necessary to lower and control groundwater levels and hydrostatic pressures, during construction, to permit excavation and construction to be performed in dry conditions.

1. Control of surface and sub-surface water are part of dewatering requirements.
2. Design and installation of temporary well point systems until completion of construction.
3. Obtain all permitting activities, including permit fees, associated with obtaining applicable permits from the South Florida Water Management District.

1.2 QUALITY ASSURANCE

A. Employ dewatering persons who have at least 5 years experience in field of dewatering.

1. Maintain adequate control so that stability of excavated and constructed slopes are not adversely affected by water; erosion is controlled; flooding of excavation or damage to structures does not occur.

1.3 SUBMITTALS

A. Methods of Operations: Plans and description of overall dewatering system proposed. Review of proposed system will only be with respect to basic principles of methods.

B. Observation Well Reports: Daily reports recording elevation of ground water and piezometric water levels in observation wells.

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. Equipment: Standard dewatering equipment of proven ability designed and manufactured by firms having experience in the design and production of such equipment. Equipment furnished shall be designed, constructed and installed in accordance with the best practices and methods.

PART 3 - EXECUTION

3.1 DEWATERING

A. Provide an adequate system to lower and control groundwater in order to permit excavation, construction of structures and placement of fill materials to be performed under dry conditions.

Install sufficient dewatering equipment to predrain water-bearing strata above and below bottom of structure foundations, drains, sewers and other excavations.

1. Reduce hydrostatic head in water-bearing strata below structure foundations, drains, sewers and other excavations to extent that water level and piezometric water levels in construction areas are below prevailing excavation surfaces at all times.
    a. Maintain piezometric water level a minimum of 2 feet below surface.

B. Prior to excavation below groundwater level, place system into operation continuously 24 hours a day, 7 days a week until drains, sewers and structures have been constructed, including placement of fill materials, and dewatering is no longer required.

C. Dispose of water removed from excavations in such a manner so as to not endanger public health, property, and portions of work under construction or completed. Dispose of water in such a manner that will cause no inconvenience to others engaged in work about site. Provide sumps, sedimentation tanks, and other flow control devices as required by governing authorities.

D. Provide complete standby equipment, installed and available, for immediate operation as may be

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required, to maintain dewatering on a continuous basis in event that any part of system fails. In event dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense.

3.2 PROTECTION AND SITE CLEAN-UP

A. At all times during the progress of the Work, the Contractor shall use all reasonable precautions to prevent either tampering with the well points or the entrance of foreign material.

B. Immediately upon completion of the use of the well point system, the Contractor shall remove all of his equipment, materials, and supplies from the site of the work, remove all surplus materials and debris, fill in all holes or excavations, and grade the site to elevations of the surface levels which existed before work started or as shown on the Drawings.

3.3 MINIMIZING NOISE DISTURBANCES

A. All dewatering pumping units shall be enclosed with noise attenuation barricades and equipped with exhaust mufflers. The dewatering pumps shall be boxed or barricaded such as to prevent or minimize disturbances to nearby residential dwellings.

END OF SECTION

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SECTION 31 31 16 - TERMITE CONTROL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide soil treatment for termite control below grade as specified.

1.3 REFERENCE STANDARDS

A. Environmental Protection Agency.

B. Florida Department of Agriculture & Consumer Services.

C. Florida Statute Chapter 482; latest version.

1.4 REFERENCES

A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

A. Submit four-copies of manufacturer's technical data and application instructions.

B. Include toxicants, composition by percentage, dilution schedule, and intended application rate.

C. Submit copy of Safety Data Sheet.

D. Soil Treatment Only:

1. Submit a "Certificate of Compliance," as part of the Closeout Documents with the following statement from the pest control company: “The building has received a complete treatment for the prevention of subterranean termites. Treatment is in accordance with rules and laws established by the Florida Department of Agriculture and Consumer Services.”

1.6 QUALITY ASSURANCE

A. In addition to the requirements of these specifications, comply with manufacturer's instructions and recommendations for the work, including preparation of substrate and application.

B. Engage a professional pest control operator, licensed by the State of Florida for application of soil treatment solution.

C. Installation must comply with the latest version of Chapter 482 Fl Statute.

1.7 JOB CONDITIONS

A. Do not apply soil treatment solution until excavating, filling and grading operations are completed except as otherwise required in construction operations.

B. Ensure penetration; do not apply soil treatment during inclement weather.

C. Comply with other handling and application instructions of the soil toxicant manufacturer.

1.8 GUARANTEE

A. Furnish four-copies of written guarantee certifying that the applied soil poisoning treatment will prevent the infestation of subterranean termites for warranty period.

1. If subterranean termite activity is discovered during the guarantee period, the Contractor is responsible for re-treat of the soil and repair or replace of damage to the building and its contents caused by termite infestation.

B. Provide guarantee for a period of 5-years.

C. The Owner reserves the right to renew warranty for an additional 5-year at an additional cost.

1.9 PROJECT CLOSEOUT

A. Record the moisture content of soil before application, date, and rate of application, areas of application, diary of toxicity meter readings and corresponding soil coverage.

PART 2 PRODUCTS

2.1 SOIL TREATMENT SOLUTION

A. Conform to applicable code for requirements and for application in accordance withEPA and Florida Department of Agriculture & Consumer Services approved emulsible concentrate insecticide for dilution with water, specially formulated to prevent infestation by termites.

B. Fuel oil is not permitted as a diluent.

C. Other solutions acceptable to local governing authorities and the EPA may be used.
   1. Use only soil treatment solutions, which are not injurious to planting.

PART 3 EXECUTION

3.1 INSPECTION

A. Before applying soil treatment for termites, examine areas and conditions; notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.
   1. Do not proceed with the work until conditions are satisfactory.

B. Verify that final grading is complete.

3.2 APPLICATION

A. Surface Preparation:
   1. Remove foreign matter that could decrease effectiveness of treatment on areas to be treated.
   2. Loosen, rake and level soil-requiring treatment, except previously compacted areas under slabs and foundations.

B. Application Rates: Apply soil treatment solution as specified and in strict accordance with Manufacturer's recommendation for mixing and application.
   1. Allow not less than 12 hours for drying after application, before beginning concrete placement or other construction activities.
   2. Termite spray shall extend 2-foot minimum from exterior facade of building(s) and 1-foot high vertically from the ground.
   3. Post signs in the areas of application warning workers of soil poisoning.
      a. Remove signs before other construction covers the treated area.
   4. Reapply soil treatment solution to areas disturbed by subsequent excavation or other construction activities following initial application.

END OF SECTION

SECTION 32 12 16 - ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SCOPE

A. The work shall consist of furnishing all materials, labor and equipment for compacting sub-grade, constructing a base course, priming the base course and constructing an asphaltic concrete surface course.

B. Submittals: Comply with the requirements of Section 01 33 00, Submittal Procedures

C. Material Certificates: Provide copies of material certificates signed by material producer and Contractor, certifying that each material item meets or exceeds specified requirements.

D. Code Compliance: Comply with the applicable standards of Martin County, if more stringent than herein specified.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials furnished hereunder shall comply with the applicable sections of the Florida Department of Transportation's (FDOT) "Standard Specifications for Road and Bridge Construction", latest edition, which are hereby incorporated into these specifications by reference.

B. MATERIALS:

General: Use locally available materials and gradations which exhibit a satisfactory record of previous installations.

1. Sub-grade Stabilizing Material: FDOT Section 160 and Section 914.
2. Base Course: Lime-rock Base Course, FDOT Section 200 and Section 911.

   Crushed Concrete Base Course, FDOT Section 204.
3. Asphaltic Concrete: Comply with FDOT Section 330 requirements and Section 334 for Type SP-12.5 and Type SP-9.5.
4. Prime and Tack Coats: Cut-back asphalt grade RC-70, meeting FDOT Section 300.
5. Lane Marking Paint: FDOT Section 971, color as indicated.

PART 3 - EXECUTION

3.1 GENERAL

A. Prior to execution of any asphalt operations, the Testing Laboratory shall be notified to review procedures and assist in the proper implementation of the Specifications. All asphalt preparation and testing shall be done under the supervision of the Testing Laboratory or his representative.

B. All operations hereunder shall be conducted in strict compliance with the requirements of Martin County standards, and with applicable sections of the FDOT Standard Specifications as follows:

C. Sub-grade Stabilization: FDOT Sections 160 and 914. Subgrade shall be as follows:

1. Subgrade beneath limerock base shall be 12” stabilized with a minimum LBR of 40 and compacted to at least 95% modified proctor maximum dry density (AASHTO T-180, ASTM D-1557).

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2. Stabilized, compacted subgrade one test every 10,000 SF or 300 LF, with a minimum of two tests, whichever is greater.
3. Perform modified moisture density relationship (Proctor) at a frequency of one test for each material type.
4. Perform Limerock Bearing Ratio (LBR) at a frequency of one test for subgrade.

D. Construction of Base Course: FDOT Section 200, for Lime-rock Base

FDOT Section 204, for Crushed Concrete Base

1. Place in maximum 8" lifts and compact each lift to a minimum dry density of 98% of the modified proctor maximum density (AASHTO T-180).
2. Perform compaction testing the full depth at a frequency of one test per 10,000 SF or 300 LF, with a minimum of two test locations, whichever is greater.
3. Perform modified moisture density relationship (Proctor) at a frequency of one test for the material type.
4. Perform Limerock Bearing Ratio (LBR) at a frequency of one test for the base type.

E. Construction of Wearing Course: FDOT Section 330.

1. Perform one extraction/gradation test per day, per 500 tons of placed material.
2. Perform asphalt core testing for density and thickness verification at a frequency of one test per 10,000 SF or 300 LF, with a minimum of two test locations, whichever is greater.

F. Pavement Markings: FDOT Sections 710 and 711.

END OF SECTION

SECTION 32 13 13 - CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 WORK INCLUDED

A. Provide all labor, materials, necessary equipment, and services to complete the Portland Cement Concrete Paving and Walks work, as indicated on the Plans and Details, as specified herein or both.

B. Including but not necessarily limited to the following:

1. Concrete pavement.
2. Concrete walks.
3. Concrete form work.
4. Concrete reinforcement.
5 Expansion, contraction, and construction joints.
6. Natural gray concrete paving flatwork.
7. Decorative concrete walks and plazas.
8. Concrete finishing and curing.
9. Concrete curbs and gutters.

1.3 WORK EXCLUDED

A. Rough Sub-Grades

B. Masonry Walls

C. Cast-in-Place Concrete Walls

1.4 RELATED WORK

A. Section 01 33 00, Submittal Procedures

B. Section 31 20 00, Earthwork

1.5 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies: Perform work in accordance with local building and other applicable codes.

B. Inspection and Testing:

1. Hardrock Aggregate: Test by approved testing laboratory in accordance with ASTM C33.
2. Limerock Aggregate: Test by approved testing laboratory for conformance with local acceptable standards and specified requirements.
    a. Do not deliver aggregates (hardrock and limerock) to site, or to ready-mix plant, until pit source has been approved, and plant, capacity, and ability to produce a uniform and continuous product has been verified.
    b. Take samples from aggregate stockpiles assigned to Project.
3. Test Cylinders - As per ASTM C-39.
    a. Minimum of three (3) concrete test cylinders shall be taken for every 75 or less cubic yards of concrete placed.

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b. Minimum of one (1) additional test cylinder shall be taken during any cold weather concreting, and be cured on job site under same conditions as the concrete it represents.

c. Test cylinders at age of seven (7) days and twenty-eight (28) days.

1) Seven-day Strength: Not less than 60% of specified ultimate 28-day strength.

d. Mix Adjustment: Should test results indicate concrete strength below specified seven day or 28 day minimum requirements, laboratory will adjust mix proportions in future batches as necessary to achieve specified minimum requirements.

e. Concrete Failures: Should test result show that concrete strength requirements for any portion of work falls below 28-day minimum requirements, secure core or prism specimens of hardened concrete and test in accordance with ASTM C42.

1) Laboratory will secure and test specimens under Owner's direction.

4. Slump Test - As per ASTM C-143:

a. Minimum of one (1) slump test shall be taken for each set of test cylinders taken.

C. Unless otherwise indicated, conform to all materials, workmanship and practice to the requirements of the following standards:

1. Florida Building Code – Eighth Edition (2023), Chapter 19.

2. The following publications from the American Concrete Institute (ACI) - latest edition:

Number/Title

211.1 Recommended Practice for Selecting Proportions for Normal Weight Concrete

211.1.1 Recommended Practice for Selecting Proportions for Structural Lightweight Concrete

301 Specifications for Structural Concrete for Buildings

302 Recommended Practice for Concrete Floor and Slab Construction

303 Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete

305 Hot Weather Concreting

306 Recommended Practice for Cold Weather Concreting

308 Recommended Practice for Curing Concrete

309 Recommended Practice for Consolidation of Concrete

318 Building Code Requirements for Reinforced Concrete

347 Recommended Practice for Concrete Formwork

3. American Society for Testing and Materials (ASTM) Standard:

C31-69 Making and Curing Concrete Test Specimen in the Field

C33-74a Concrete Aggregates

C39-72 Compressive Strength of Cylindrical Concrete Specimens

C42-68 Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

C94-74a Ready-Mixed Concrete

C150-76a Portland Cement

C171-69 Sheet Materials for Curing Concrete

C172-71 Sampling Fresh Concrete

C192-69 Making and Curing Concrete Test Specimens in the Laboratory

C260-741 Air-Entraining Admixtures for Concrete

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C309-74 Liquid Membrane-Forming Compounds for Curing Concrete

C330-75a Lightweight Aggregates for Structural Concrete

C418 Test for Abrasion Resistance of Concrete by Sandblasting

C494-71 Chemical Admixtures for Concrete

C595-75 Blended Hydraulic Cements

C618-73 Fly Ash and Row or Calcined Natural Pozzolan for Use as a Admixture in Portland Cement Concrete

C803 Penetration Resistance of Hardened Concrete

C805 Rebound Number of Hardened Concrete

C823 Examination and Sampling of Hardened Concrete in Construction

D. Where provisions of pertinent codes and standards conflict with this specification, the more stringent provisions govern.

1.6 QUALIFICATIONS OF WORKMEN

A. Provide at least one (1) person at all times during execution of this portion of the work who is thoroughly trained and experienced in placing the types of concrete specified to direct all work performed under this section. For finishing of exposed surfaces of the concrete, use only thoroughly trained and experienced journeyman concrete finishers.

B. Decorative Concrete: Provide documentation of experience placing and finishing colored, stamped concrete as specified herein. Ensure that the placement and finishing of decorative concrete on this project is performed by experienced personnel. One method of demonstrating the required level of experience is to provide a list of completed projects and the contact person for the project owner(s) to the Engineer at the pre-construction meeting. The project list must demonstrate satisfactory completion of a minimum of 10,000 square feet of colored, stamped concrete.

1.7 PLANT QUALIFICATION

A. Meet all requirements of the Check List for Certification of Ready Mix Concrete Production Facilities of the National Ready Mixed Concrete Association and ASTM C94.

1.8 SUBMITTALS

A. Procedures: Submit shop drawings in accordance with Section 01 33 00.

B. Test Reports: Report of concrete compression, yield and slump tests.

C. Certificates:

1. Submit manufacturer's certification that concrete mix materials meet specified requirements.
2. Material content per cubic yard of each class of concrete furnished:
    a. Dry weights of cement.
    b. Saturated surface-dried weights of fine and coarse aggregate.
    c. Quantities, type and name of admixtures.
    d. Weight of water.
3. Ready-mix delivery tickets, ASTM C94.

D. Product Data: Manufacturer's product literature and application/installation procedures for all products intended for use in the work such as, but not limited to, joint sealants, admixtures, and curing materials.

E. Submit shop drawings and the following to Owner:

1. Plant Qualifications: Submit satisfactory evidence indicating compliance with the specified qualification requirements.

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2. Materials: Submit satisfactory evidence indicating that all materials listed in Part 2 meet the specified requirements.

3. Design Mix: Submit the design mix to be used for review prior to placing of concrete. The design of the mix is the responsibility of the Contractor, subject to the limitations of the specifications.

F. Do not place concrete until submittals have been reviewed and approved by the Engineer.

1.9 TRANSMIT-MIX DELIVERY SLIPS

A. Keep a record at the job site showing time and place of each pour of concrete, together with transit-mix delivery slips certifying contents of the pour. Make the record available to the Owner for his inspection upon request. Upon completion of each portion of the work, deliver a copy of the record and the delivery slips to the Owner.

1.10 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacturer's original containers, clearly labeled with manufacturer's name and address and product identification.

B. Store materials in original containers protected from direct contact with the ground and from the elements.

1.11 JOB CONDITIONS

A. Allowable concrete temperatures:

1. Hot Weather: Maximum 90 Degrees F as per ASTM C-94 and ACI 305.

2. Cold Weather: In accordance with ACI 306.

B. Do not place concrete during rain, unless adequate protection is provided.

C. Grade Control: Establish and maintain the existing lines and grades, including crown and cross-slope as indicated on the drawings. All concrete surfaces must positively drain toward drainage structures. Any pavement surface which does not positively drain or allows water to pond shall be removed and replaced by the contractor at no additional cost to the Owner.

D. Maintain temperature of concrete above 50 Degrees F for seven (7) days after placing. Protect work against frost and rapid drying.

E. Traffic Control:

1. Restrict vehicular and pedestrian traffic during all paving operations, as required for other construction activities. Obtain Owner approval prior to rerouting any traffic.

2. Provide flagmen, barricade, warning signs, and warning lights for movement of traffic and safety, and to cause the least interruption of work.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A. General: Use ready-mixed concrete, batched, mixed, and transported in accordance with ASTM C94 unless otherwise indicated.

B. Cement: For all concrete use domestic Portland cement that conforms to the requirements of ASTM C150-76a, Type I.

C. Fine Aggregate, Hardrock: ASTM C33, consisting of washed sand having hard, strong, durable particles which do not contain more than one percent (1%) by weight of such deleterious substance as clay lumps, shale, schist, alkali, mica,, coated grains or soft and flaky particles.

D. Coarse Aggregate Hardrock: Use clean, coarse limestone aggregate in accordance with ASTM C33-74a.

E. Water: Clean and potable, free from deleterious amounts of acids, alkalis, salts, or organic matter.

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2.2 CONCRETE MIXES

A. It is intended that concrete for all parts of the concrete work be homogenous, and when hardened, possess the required strength, durability, watertightness, appearance, resistance to deterioration and abrasion, and other qualities as specified or required.

B. It is also intended that all concrete of the same specified concrete mix shall match throughout the site. Concrete placed adjacent to concrete of the same specified mix that was placed in a previous pour shall be uniform in color to that concrete.

C. Mix Proportioning: Use only mixes designed by a laboratory selected or approved by Owner. Ready-mixed concrete in accordance with ASTM C94.

1. Provide concrete which will develop ultimate compressive strength at 28 days equal to 3,000 PSI.

D. Entrained Air: All concrete which will be exposed to water or air shall be designed to entrain 4%-6% air.

E. Design Slumps: Slabs on Grade shall be four inches (4") plus/minus one inch (+1").

F. Concrete mix design shall be in accordance with ASTM C94.

2.3 CONCRETE ADMIXTURES

A. Concrete Admixture Types:

1. ASTM C494, water reducing.
2. ASTM C494, water reducing and retarding.
3. Air Entraining: ASTM C260. For all concrete exposed to water or air.
    a. Do not use air entraining admixture in concrete with Ipanex special waterstop admixture.

B. Quality: Conform to ASTM designations specified for the various types.

1. Do not use admixtures which cause excessive (up to 10% more than concrete without admixtures) shrinkage.
2. Do not use admixtures which contain calcium chloride or triethanolamine.
3. Do not use admixtures which cause corrosion of embedded steel.

2.4 CURING COMPOUND

A. Use only compounds that will not affect bond of coatings or toppings in accordance with ASTM C309, Type 1 or Type 2.

2.5 CEMENT GROUT

A. Cement Grout: Mix one part Portland Cement, 2-1/2 parts fine aggregate, and water enough for required consistency. Depending on space, consistency may range from mortar consistency to a mixture that will flow under its own weight. Use for leveling, preparing setting pads or beds, for filling non-structural voids, and similar uses. Do not use for grouting under bearing plates or structural members in place.

B. Non-Shrink Grout: Acceptable compounds and manufacturers:

1. Master Flo 713, by Masters Builders Company
2. Five Star Grout by U.S. Grout Corporation
3. Upcon by the Upco Co.
4. Horn Non-Metallic Grout by A.C. Horn, Inc.
5. Sonogrout by Sonneborn Building Products
6. Vibropruf #11, Lambert Corp.

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2.6 FORMWORK AND ACCESSORIES

A. Formwork: Matched, tight fitting and adequately stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of concrete, conform with ACI 347, Chapter 4, "Materials for Formwork".

B. Use forms with a depth equal to the plan dimensions for the depth of concrete being deposited against them. Forms shall be straight, free from warp or bends, and of sufficient strength when staked to resist the pressure of the concrete without deviation from line and grade. Clean the forms each time they are used, and saturate with water prior to placing the concrete.

C. Lumber: Softwood framing lumber: Kiln dried, PS-20.

D. Plywood: Exterior type softwood plywood, PS 1-66.

E. Form Coatings: Non-staining clear coating which does not contain oil or wax and will not prevent proper adhesion of applied finishes.

1. "Formshield", by A.C. Horn, Inc.
2. "Release", by Burke Concrete Accessories.
3. "Magic Kote", by Symons.
4. Form Release-88 by Lambert Corp.
5. "Cast-Off" by Sonneborn Building Products.

F. Metal Construction Joints: "Keyed-Kold", by Burke Concrete Accessories.

G. Pressure Sensitive Tape: 3M or equivalent, polyurethane, or mylar faced adhesive backed paper tape, one inch (1") wide. Use for formwork joints.

H. Formwork Product Handling: Store materials above ground on framework or blocking, and cover with protective waterproof covering. Provide for adequate air circulation throughout material stacks.

2.7 REINFORCEMENT

A. In accordance with ACI 301.

B. Submittals:

1. Procedure: Submit in accordance with Section 01 33 00.

C. Reinforcing Steel: ASTM A615, Grade 60, free from loose rust and scale.

D. Dowels: ASTM A615, Grade 60, free from loose rust and scale.

E. Welded Wire Mesh: Use welded wire mesh 6" x 6" x 10/10 in accordance with applicable specifications of the welded wire mesh institute.

2.8 PREFORMED EXPANSION JOINT FILLER AND SEALANT

A. Expansion Joint Filler: Premolded type, ASTM D1751. Approved manufacturers:

1. A.C. Horn Company
2. Homasote Company
3. W.R. Meadows Company

B. Minimum 1/2" thick asphaltic impregnated fiberboard expansion joint filler. Locations as indicated on plans. Expansion joint filler to be full depth of slab thickness at joint as indicated on drawings. Contractor shall install expansion joints as detailed on the drawing where concrete pavement abuts all vertical surfaces including but not limited to all buildings, structures, curbs, columns, walls, light poles, etc.

C. Expansion Joint Handling:

1. Deliver materials in manufacturer's original containers, clearly labeled with manufacturer's name and address and product identification.

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2. Store materials in original containers protected from direct contact with the ground and from the elements.

3. Store materials above ground on framework or blocking, and cover with protective waterproof covering. Provide for adequate air circulation throughout material stacks.

D. Expansion joint backer rod shall be round, closed cellpolyethylene rod with a diameter of 1/8" (3 mm) larger than the width of the joint.

2.9 DECORATIVE CONCRETE

A. Furnish tools and stamping equipment as recommended by the stamping system manufacturer and as approved by the Engineer. Use stamping equipment and materials from a single manufacturer throughout the entire project.

B. Pattern and Finish - Selected by the Architect from manufacturer's full range of available textured stone/slate patterns.

C. Color - Selected by the Architect from manufacturer's full range allowing for up to three different colors.

D. Coloring Agent - Produce the colored concrete using an iron oxide type pigmented admixture conforming to ASTM C 979 added at the concrete batch plant and dry-shake color hardeners added in place.

E. Clear Surface Sealant - Apply a low-luster, matte finish, clear coating recommended by the stamping system manufacturer to protect the imprinted concrete surface.

PART 3 - EXECUTION

3.1 BARRICADES

A. Provide substantial temporary barricades around all areas of operation and maintain until work under this section is completed and approved.

B. Install temporary traffic markers, signals, and signs as per D.O.T. Standard Specifications to:

1. Eliminate potentially hazardous conditions.

2. Maintain adequate traffic patterns free of conflict with work under this Contract.

3.2 INSPECTION

A. Examine all surfaces over which concrete is to be applied.

1. Ensure that no defects, low sections, depressions, or holes are present which would jeopardize the standard of finish specified.

B. Compact subgrade using heavy vibratory equipment. Check for unstable areas. Check for areas requiring additional compaction.

C. Assure that compacted subgrade or base and formwork are completed and that excess water has been removed from excavations.

1. Verify elevations of base are correct.

D. Verify that steel reinforcements, expansion joint materials and other embedded items are in their proper locations and adequately secured against shifting during placement of concrete.

E. Place no concrete until forms, base, reinforcement, and other embedded items have been reviewed and approved by Owner's Representative, Architect, or Engineer with a minimum of 24 hours' notice.

3.3 PLACEMENT OF LIMEROCK BASE

A. In locations where compacted backfill cannot achieve 98% compaction, place and level limerock base over prepared subgrade to a compacted depth of twelve inches (12") or as required by soils and subsurface investigation, true to lines and levels. Compact to 98% compaction as per AASHTO T-180.

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3.4 FORMWORK

A. Provide formwork design for all concrete paving. Coordinate design, construction, and placement with all other trades and contractors.

B. Set the forms straight, free from warp or bends, and true to line and grade. Set forms with a 1/8" per foot cross slope or as shown on plans. Construct all concrete paving 4-inch or 6-inch slab thickness as indicated on plans.

C. Contractor is responsible for the design, construction, removal, and complete safety of formwork and shoring.

D. Design formwork so it will be sufficiently tight to prevent leakage during concrete placement.

E. Construct formwork as required to obtain the exact size, shape, line level, alignment, location, elevation and grades, as indicated on drawings for the finished structure.

F. Fill voids of plywood joints with sealant and tool smooth.

G. Form vertical surfaces to full depth and securely position to required lines and levels. Ensure form ties are not placed so as to pass through concrete.

H. Arrange and assemble formwork to permit easy dismantling and stripping, and to prevent damage to concrete during formwork removal. Avoid hammering or prying against concrete surfaces.

I. Cleaning and Tightening:

1. Thoroughly clean form and remove chips, wood, sawdust, dirt, or other debris just before concrete is to be placed.
2. Re-tighten forms during or immediately after concrete placement, as may be required, to eliminate any leaks.

J. Taping of Joints:

1. Apply pressure sensitive tape over all formwork joints which will be exposed in the finish work.
2. Apply tape on inside (concrete side) of formwork to prevent loss of cement paste and joint discoloration.
3. Tape joints before form release agent is applied to formwork.

K. Coat form contact surfaces with form-coating compound before reinforcement is placed. Do not allow excess form coating material to accumulate in the forms or to come into contact with surfaces which will be embedded in concrete. Apply in compliance with manufacturer's instructions.

L. Edge Forms and Screeds Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in the finished slab surfaces. Provide and secure units to support types of screeds required.

M. Coordinate work of other sections in forming and setting openings, slots, recesses, sleeves, bolts, anchors, and other embedded items.

N. Install accessories in accordance with manufacturer's instructions, level and plumb. Ensure items are not disturbed during concrete placement.

O. Do not remove forms and shoring until concrete has sufficient strength to support its own weight, and construction and design loads which may be imposed upon it. Remove load supporting forms when concrete has attained seventy-five percent (75%) of required 28-day compressive strength, provided construction is re-shored.

3.5 SLAB REINFORCEMENT

A. Remove loose rust and mill scale, earth, form oil, or any other materials which may reduce or destroy bond with concrete.

B. Position, support, and secure reinforcement against displacement by moving loads, vibration, or other concrete placement operations.

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1. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers as required.
2. Do not deviate from alignment or measurement.

C. Maintain two inch (2") minimum concrete coverage around welded wire mesh, reinforcing steel, dowels, and other embedded items.

D. Set mesh or bars in form and support with rebar chairs and/or Baser Brick (2' on center) so concrete will flow under it. Do not allow reinforcing to come into ground contact.

E. Arrange, space, and securely tie welded wire fabric and supports together with 16-gauge wire to hold reinforcement accurately in position during concrete placement operations.

1. Set wire ties so that twisted ends are directed away from exposed concrete surfaces.

F. Provide sufficient numbers of supports and of strength to carry reinforcement.

G. Do not extend reinforcing through expansion and contraction joints. Provide doweled joints through expansion and contraction joints.

H. Place construction joints perpendicular to the main reinforcement.

3.6 JOINTS (EXPANSION, CONSTRUCTION, AND CONTRACTION)

A. Form expansion joints one-half inch (1/2") thick with a preformed joint filler. Expansion joints to be located as indicated on plans. Expansion joint to be full depth of slab at joint location. Recess joint filler one-half inch (1/2") from surface.

B. Construct doweled expansion joints as designated on the drawings and in the specifications. Insert one end of dowel in Schedule 40PVC pipe and cap so concrete does not bond to dowel in order to permit horizontal movement. Dowels shall be installed level, parallel to one another, parallel to the length of the slab, and positioned as detailed at one-half of the slab's thickness. The expansion joint material shall be centered over the mid-length of the dowels, and installed as specified above. In order to meet the foregoing requirements, use fabricated dowel baskets placed directly on the subgrade as recommended. Contractor shall submit shop drawings of dowel basket for approval if used.

C. Construct pour joints (construction joints) at any break in concrete placement lasting more than one (1) hour.

1. Construction pours shall be continuous pours except where joints are indicated. No additional joints other than those shown on plans are allowed.
2. Key all pour joints.
3. Pour joints may be substituted for control joints when treated as part of paving design as indicated on plans.

D. Construct control joints (contraction joints) at locations indicated on plans.

1. For four-inch (4") depth concrete slabs on grade, saw cut control joints shall be one-quarter inch (1/4") width and one inch (1") in depth.
2. For six-inch (6") depth concrete slabs on grade, saw-cut control joints shall be one-quarter inch (1/4") width and one and one-half inch (1-1/2") depth.
3. Form open-type contraction joints by staking a metal bulkhead in place and depositing the concrete on both sides. After the concrete has set sufficiently to preserve the width and shape of the joint, remove the bulkhead. Finish joint to match appearance of saw cut.
4. Accurately lay out areas according to plans and make all joints straight and true with clear-cut angles.

3.7 INSPECTION

A. Assure that excavation and formwork are completed, and excess water is removed.

B. Check that reinforcement is secured in place.

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C. Verify that expansion joint materials, anchors, and other embedded items are secured in position.

3.8 PLACING CONCRETE

A. Equipment forms and reinforcing shall be clean and wet down, reinforcing firmly secured in place, runways set up and not resting on or displaying reinforcing.

B. At locations where new concrete is doweled into existing work, drill holes in existing concrete, insert steel dowels as indicated on drawings and pack solid with non-shrink grout. Cover exposed end with capped Schedule 40 PVC sleeve to allow free movement as indicated on drawings.

C. Place concrete in the forms to the required depth. Tamp and spade until mortar entirely covers its surface.

D. Place concrete, screed and wood float surfaces to a smooth and uniform finish.

E. Avoid working mortar to surface.

F. Round all edges, including edges of expansion, contraction and control joints, with 1/4 inch radius edging tool.

G. Ensure finished surfaces do not vary from true lines, levels or grade by more than one-eighth inch (1/8") in ten feet (10') when measured with straight edge.

H. Apply curing compound on finished surfaces immediately after placement. Apply in accordance with manufacturer’s recommendations.

3.9 CONCRETE PAVING INSTALLATION

A. Placing concrete according to ACI.

1. Before placing any concrete in formwork, thoroughly clean and remove all foreign matter and water from forms or structural excavations.
2. Mix and deliver concrete only in quantities for immediate use.
3. Do not re-temper or use set concrete.
4. If earth at bottom of forms has dried out, re-wet so that soil is moist but free of standing water and mud.
5. Convey concrete from mixer to final position by methods which will prevent separation or loss of materials.
6. Maximum height of concrete free fall is four feet (4').
7. Regulate rate of placement so concrete surface is kept level throughout; a minimum being permitted to flow from one area to another. Control rate of pour consistent with form design.
8. Deposit concrete in continuous operation until section being placed has been completed.
9. Ensure finished surfaces do not vary from true lines, levels or grade by more than 1/8 inch in 10 feet when measured with straight edge.
10. Apply curing compound on finished surfaces except exposed aggregate concrete pavement immediately after placement. Apply in accordance with manufacturer's recommendations.

3.10 CONCRETE FINISHES

A. All concrete flatwork finishes shall be slip resistant with a coefficient of friction of .5 according to ASTM C418. The contractor shall verify slip resistance requirements of all sample panels of finishes prior to executing the work and provide abrasive aggregate as specified, if necessary.

B. Tamp freshly-placed concrete with approved metal grid tampers not less than 12 inches x 12 inches in size so as to bring fines to top, then rod to uniform surface at required levels.

1. Float and trowel finish as soon as surface becomes workable.
2. Provide slopes as indicated on drawings, pitch to drains.

3. Work and measure concrete flatwork until it is level to within 1/8 inch in 10 feet in any direction.

3.11 DECORATIVE CONCRETE

A. Arrange with the stamping system manufacturer to have a representative on site for the first workday of decorative concrete placement.

B. The Engineer will determine whether the representative is required on site for additional days to ensure satisfactory results.

C. Construct a test section, consisting of at least 25 square feet, for approval by the Engineer and the Authorized Owner's Representative for color, texture, and workmanship. Seal the surface of the test section and include one saw-cut and sealed joint.

D. Keep the approved test section at the worksite as a standard for judging the completed work. Any portion of the completed work that does not match the workmanship of the approved test section must be removed and replaced. All costs associated with this removal and replacement will be borne by the Contractor.

E. Construct concrete walks, plazas and pavement in accordance to this section and as recommended by the stamping system manufacturer. Apply pigmented release agent to tools and forms in accordance with the stamping system manufacturer's specifications. Place concrete and screed to the specified grade. Float the surface and evenly apply dry shake color hardener according to manufacturer's specifications.

F. Imprint the surface of the plastic concrete with the forms to obtain the specified pattern. The pigmented release agent will serve as the curing agent. Do not clean the surface until adequate curing has been obtained, as recommended by the stamping system manufacturer.

G. Saw cut all joints one-quarter inch wide and one inch deep, following the joint patterns illustrated in the typical sections, or as directed by the Engineer. Seal all joints, including expansion joints and sawed joints, with color-matched joint sealant, as recommended by the stamping system manufacturer. Apply two coats of low-lustre, matte finish clear surface sealer to the finished decorative concrete as recommended by the stamping system manufacturer.

H. Take steps to avoid the contamination of adjacent surfaces while placing and finishing colored, stamped concrete; clean all surfaces that do get contaminated. Areas that were not properly protected and/or cannot be cleaned to the satisfaction of the Engineer must be removed and replaced. All costs associated with this removal and replacement will be borne by the Contractor.

3.12 PROTECTION

A. Protect freshly placed concrete from damage due to water, falling objects, or persons marring finish surface of concrete. Surfaces damaged due to lack of protective measures shall be removed and replaced with fresh concrete at no additional cost to the Owner.

B. Protect finished surface from damage by work of other trades due to subsequent work.

C. Protect slab surfaces to be left exposed from damage during subsequent construction operations and make necessary repairs to damaged areas, returning to original condition.

3.13 BACKFILLING AND COMPACTING

A. After the concrete has set sufficiently, refill the spaces adjacent to the concrete to the required elevation with suitable material. Place and thoroughly compact ninety percent (90%) of relative density.

3.14 FIELD QUALITY CONTROL

A. Test Cylinders: Take sample test cylinders of each mix design, as directed by Owner.

1. Test cylinders in accordance with ASTM C39. Test cylinders at (7) days.

2. Perform slump tests for each set of test cylinders.

B. Certifications:

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1. Provide batch tickets signed by the dispatcher and the laboratory inspector at the ready-mix plant. Each batch ticket shall state batch quantities of cement, water, fine aggregates, coarse aggregates, and admixture contained in each truck load.
2. Mixer truck driver shall deliver to Owner's Representative on job site a properly signed ticket with each load of ready-mix concrete.

C. Contractor shall provide all test specimens as required by laboratory as part of the work of this Section.

3.15 DEFECTIVE CONCRETE

A. Concrete will be deemed defective when:

1. Tests on core or prism specimens fail to show strengths specified.
2. Not formed as indicated or detailed.
3. Not plumb or level where so indicated.
4. Not true to intended grades and levels.
5. Cut, filled or resurfaced, unless under direction of Owner.
6. Debris is embedded therein.
7. Not fully in conformance with provision of Contract Documents.
8. Expansion and control joints which do not conform to plan locations or are not straight and true.
9. Does not positively drain toward drainage structures or water ponds on walkway surface.

B. Defective concrete shall be removed and replaced, or at discretion of the Owner's Representative, adequately strengthened and resurfaced in a manner acceptable to Owner.

3.16 CLEAN-UP

A. Remove all debris and excess material immediately from project site.

B. Take down all barricades and temporary traffic markers, signals and signs only after all work included in this section is finished and inspected, and only after so directed by Owner's Representative.

C. Leave project area neat, orderly, and free of any hazardous conditions.

3.17 GUARANTEE

A. The Contractor shall guarantee all work and materials contained in the section of the specification and as indicated on the drawing for a two (2) year period commencing on the date on which all of the work or designated portion thereof is substantially complete according to the General Conditions.

B. The Contractor shall remove and replace any of his work that expands, settles, spalls, cracks (beyond normal shrinkage), chips, or deteriorates during the designated guarantee period at no additional cost to the Owner.

END OF SECTION

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SECTION 33 11 00 - WATER UTILITY DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. For water main construction within the public right-of-way and utility easements (as delineated on the plans) refer to the Standards and Specifications for Water and Wastewater Main Construction by Martin County Utilities, which is incorporated into these specifications by reference.

1.2 DESCRIPTION OF WORK

A. Extent of water service piping work is shown on the drawings.

B. Exterior water service piping work includes, but is not limited to, the following:

1. Water main and service piping
2. Control valves
3. Fire hydrants
4. Water meters
5. Backflow prevention devices

C. Comply with requirements of Section 03 30 00, Cast-in-Place Concrete for concrete work required in connection with exterior water service piping.

1.3 QUALITY ASSURANCE

A. Installer: A firm with at least two (2) years of successful installation experience on exterior water service piping projects similar to this project.

B. Code Compliance: Comply with applicable portions of National Standard Plumbing Code, local plumbing codes, the NSF International Standard 61, AWWA Standards, Martin County Utilities standards and the regulations of the Florida Department of Environmental Protection, and NFPA 24.

1.4 SUBMITTALS

A. Product Data: Submit manufacturers' technical data and installation instructions for each major component for the water system materials and products.

B. Submit drawings labeled as "Record Drawings" containing the following information, signed and sealed by a Registered Land Surveyor (State of Florida):

1. Location of water main tied to the project coordinate system or an acceptable base line (base line shall be tied to property lines).
2. Location of each valve, fitting, service line, blow off points, etc.
3. Length and location of service lines.
4. Fire hydrant locations, shut off valve, type of hydrant used, and distance from centerline of pumper nozzle to finish grade.
5. Valve types used.
6. Type of material used, mains and services. Indicate all locations of changed materials including mechanical joint vs. slip joints.
7. Indicate depth of cover over water mains if other than 30 inch, or at 100 ft. intervals (minimum).
8. Dimensions between pipes, elevations of pipes, and actual pipe materials where water lines cross sanitary sewer, reclaimed water and/or storm lines when the separation is less than the minimum 18-inch vertical clearance.

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9. Include any additional information specifically required by agencies having jurisdiction and the FDEP permit for this project.

C. An electronic copy of the Record Drawing shall be provided to the Architect in AutoCADD format prior to final acceptance of the work.

D. Maintenance Data: Submit maintenance data and parts lists for water system materials and products. Include this data, shop drawings, product data and record drawings in a maintenance manual to be presented to the Owner at project closeout.

PART 2 - PRODUCTS

2.1 POLYVINYL CHLORIDE PIPE (PVC)

A. PVC pipe of nominal diameter four (4) through twelve (12) inches shall be manufactured in accordance with AWWA Standard C900, latest edition. The PVC pipe shall have a minimum working pressure rating of 150 psi and shall have a dimension ratio (DR) of 18 for all potable water or combination systems. The PVC pipe shall have a minimum working pressure rating of 200 psi and shall have a dimension ratio (DR) of 14 for all fire water systems. Pipe shall have the same O.D. as ductile iron pipe. Pipe shall have a color of blue or white with blue stripes.

B. PVC pipe smaller than three (3) inches shall be Polyethylene (PE) Pressure Pipe and Tubing in accordance to AWWA C-901, latest edition. The pipe shall bear the National Sanitation Foundation (NSF) logo for potable water use. Pipe shall have a color of blue or white with blue stripes.

C. PVC pipe joints shall have integral bell push-on type joints conforming to ASTM D-3139.

D. PVC pipe fittings shall be mechanical joint ductile iron or gray iron conforming to ANSI/AWWA A21.10/C110, 250 psi minimum pressure rating, or ductile iron compact fittings three (3) through twenty-four (24) inches in accordance with ANSI/AWWA A21.53/C153. Pipe fittings shall not contain more than 0.25% lead, and any solder or flux shall not contain more than 0.2% lead. All fittings shall be mechanically restrained.

2.2 DUCTILE IRON PIPE (DIP)

A. Ductile iron pipe shall be cement-mortar lined, Pressure Class 350, mechanical or push-on joint and shall meet all the requirements of the following: AWWA C-104; AWWA C-111 (for rubber gasket joints); AWWA C-150 (for thickness design); and /AWWA C-51 (for D.I.P. molds).

1. Lining: All ductile iron pipe and fittings shall be cement-mortar lined and seal coated in conformance with ANSI A-21.4.

2. Joints: Pipe joints shall be mechanical or push-on joints, except where specifically shown or detailed otherwise.

3. Pipe Fittings: All fittings 4" in diameter and larger shall be mechanical joint ductile iron or gray iron conforming to ANSI/AWWA A21.10/C110, 250 psi minimum pressure rating, or ductile iron compact fittings three (3) through twenty-four (24) inches in accordance with ANSI/AWWA A21.53/C153. Pipe fittings shall not contain more than 0.25% lead, and any solder or flux shall not contain more than 0.2% lead. Mortar lining and seal coat for fittings shall be same thickness specified for pipe. All fittings shall be mechanically restrained.

2.3 GASKET MATERIAL

A. Gaskets: The rubber-ring gaskets shall be suitable for the specified pipe sizes and pressure and shall conform to applicable parts of the latest Federal Specification WW-F-421 and AWWA/ANSI C111/A21.11, and shall be furnished with the pipe.

B. Joint Lubricant: The joint lubricant for push-on joint pipe shall have been tested and approved for potable water service. No lubricant shall be used that will harbor bacteria or damage the gaskets.

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2.4 CONTROL VALVES

A. General: Provide valves and flow control devices as indicated. All valves 4" and larger shall be furnished with mechanical joint ends.

1. Minimum working pressure, 200 psi unless otherwise indicated.

B. Gate Valves (4" and larger): Resilient seat type with non-rising stem, except use rising stem valves above ground, cast iron body meeting ASTM A126 and bronze fittings conforming to AWWA C-509. Gate valves located on fire protection mains must be FM approved. All ferrous surfaces inside and outside shall have a fusion-bonded epoxy coating. A 2 inch wrench nut shall be provided for operating the valve in a buried installation.

C. Valve Boxes: Shall be of cast iron three piece boxes with adjustable top. The size shall be large enough for operation of the valve on which it is used with a minimum shaft diameter of 5-1/4". The cover shall have the word "WATER" cast on it.

D. Gate Valves (Smaller than 4"): Shall be non-rising stem, hand-wheel operated, wedge discs, all bronze with flanged ends, conforming to Fed. Spec. WW-V-54, Class B, Type II.

1. For below ground installation, valves shall be furnished with mechanical joint ends or iron pipe thread and 2" square operating nut.

2.5 THRUST RESTRAINTS

A. General: Provide mechanical pipe joint restraints as necessary to prevent movement of pipe or piping system appurtenances in response to thrust exerted by water under pressure.

1. All mechanical constraints shall be galvanized or otherwise rust-proofed as approved by the Engineer.

2. Concrete thrust block are NOT an acceptable form of mechanical restraint.

2.6 METER ASSEMBLIES

A. General: The Contractor shall furnish and install all water meters and backflow prevention devices. Back flow prevention devices shall be furnished, installed and certified by the Contractor.

1. The Contractor shall coordinate with Martin County Utilities for the water meters to be furnished and installed by the Contractor.

2. Contractor to paint all above-ground potable water piping and backflow assemblies blue and all fire line piping and backflow assemblies red. **Stainless steel components of the assemblies shall not be painted.**

3. Provide backflow preventers conforming to requirements of the water utility. Checks shall have reversible elastomer discs and shall produce drip tight closure against back-pressure or back-siphonage. If a bypass line is required, it shall include a meter, small diameter reduced pressure zone assembly, and isolation valves. All elements shall be lead free.

a. Double Check type larger than 2 inches shall consist of two independent check modules within a single housing, with sliding sleeve access, four test cocks, and two drip-tight shutoff valves. Checks shall be removable and serviceable without the use of special tools. The housing shall be constructed of type 304 (Sch. 40) stainless steel pipe with grooved-end connections.

b. Reduced Pressure Zone Assembly type larger than 2 inches shall consist of two independent torsion spring check modules, a differential pressure relief valve located between and below the two modules, two drip-tight shutoff valves. Torsion spring check modules and relief valve shall be contained within a sliding sleeve accessible single housing constructed of type 304 (Sch. 40) stainless steel pipe with grooved-end connections.

c. Reduced Pressure Zone Assembly type 2 inches or smaller shall consist of a lead-free body with polymer check valve seats, stainless relief valve seats,

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stainless steel springs, and threaded connections. Provide factory air-gap fitting where installed inside building and pipe to nearest floor drain.

d. Backflow preventers shall be above grade assemblies only.

e. Backflow prevention devices for both potable water and non-potable shall comply with these requirements.

f. Provide isolation valve within 2 feet upstream of all backflow prevention devices serving lift stations or dumpster area hose bibbs.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install water piping system in compliance with local governing regulations.

B. Install all backflow preventers 12 to 28 inches above grade to bottom of center of unit, unless otherwise required by the utility provider.

C. Water Service Piping: Extend water service piping of size and in locations indicated to water service entrance at buildings. Connections shall be made 5'-0" outside of building lines.

D. Polyvinyl Chloride (PVC) Pipe and Fittings: Install in accordance with Uni-bell Handbook of PVC Pipe and in accordance with AWWA C-900.

E. All PVC pipe 4 inches and larger shall have a #10 GA copper trace wire located directly above the line and terminate on a metal device accessible from the surface without excavation. In addition, plastic marker tape marked “WATER” shall be located no less than 2 feet directly above the water main. Owner’s representative shall field verify the tape and locator wire installations prior to backfilling the trench.

F. Control Valves: Install in accordance with manufacturer's instructions.

G. Fire Hydrant Assemblies: Install in accordance with Martin County Utilities and Fire Department requirements.

H. Interior Inspection: Inspect conduit to determine whether line placement or other damage has occurred.

1. If the inspection indicates poor alignment, debris, displaced pipe, infiltration or defects, correct such defects to satisfaction of Architect/Engineer.

I. Cleaning Conduit: Clear interior of conduit of dirt and other superfluous material as work progresses. Maintain swab or drag in line and pull past each joint as it is completed.

J. Place plugs in end of uncompleted conduit at end of day or whenever work stops.

K. Disinfection: At completion of water service line installation, flush and disinfect in conformance with AWWA C-651 and local authorities having jurisdiction. Contractor shall provide satisfactory bacteriological test reports at the locations indicated in the Florida Department of Environmental Protection Water Permit and/or as directed by the Engineer of Record. The costs of these tests shall be the responsibility of the Contractor.

L. Utility Crossings: Contractor shall notify the Engineer-of-Record of all utility crossings between potable water lines and sanitary or storm mains. Notification shall be provided in such a manner as to allow the Engineer-of-Record to inspect the crossing prior to backfilling activities.

3.2 TESTING

A. Hydrostatic and Leakage Test: All pipe of whichever size and material installed on the project for the purpose of conveying water or liquid under pressure shall be tested after installation in accordance with the applicable portions of the hydrostatic tests for PVC pipe in AWWA C 605 and for DIP in AWWA C 600. Tests shall be made on sections not exceeding 2,000 feet. Acceptable leakage must be less than the number of gallons per hour as determined by the following formula:

For PVC Pipe:

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$$L = \frac{ND(P)^{.5}}{133{,}200}$$

Where:

L = Allowable leakage, in gallons per hour

N = Length of pipe tested, in feet

D = Nominal diameter of pipe, in inches

P = Average test pressure during leakage test, in psig

For Ductile Iron Pipe:

$$L = \frac{SD\sqrt{P}}{133{,}200}$$

Where:

L=Allowable leakage, in gallons per hour

S=Length of pipeline tested, in feet

D=Nominal diameter of pipe, in inches

P=Average test pressure during leakage test, in psig

B. All fire lines shall be tested to 200 psi test pressure for two (2) hours duration. Potable water lines shall be tested to 150 psi test pressure for two (2) hours. All gauges and appurtenances necessary shall be furnished by the Contractor. All leaks shall be repaired by removing and replacing defective pipe and joints with pipe and joints free of defects, after which the lines shall be retested. Such repair and retesting shall be done until the lines pass the specified test. The Engineer-of-Record, or their designee, shall be present for the hydrostatic testing.

C. All valves shall be hydrostatically tested with the line in which they are installed.

D. Perform operation testing of hydrants and valves by opening and closing under water pressure to ensure proper operation.

E. Backflow prevention devices shall be field tested after installation. Copies of test report shall be provided as follows:

1. Submit copy to MCPS grounds irrigation representative
2. Submit copy to Engineer of Record

3.3 BACKFILLING

A. Conduct backfilling operations of open-cut trenches closely following laying, jointing and bedding of pipe, and after initial inspection and testing are completed.

3.4 PLACING SYSTEM INTO SERVICE

A. General: The water system shall not be placed into service until all required testing has been completed, approved by the Engineer, and a “Clearance for Use” certification has been issued by the Florida Department of Environmental Protection.

B. The Contractor is required to provide the required acceptable hydrostatic and bacteriological test results and a sealed certified as-built drawing of the utility installation to the Engineer -of-Record.

END OF SECTION

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SECTION 33 31 00 - SANITARY UTILITY SEWERAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SCOPE

A. This section includes sanitary sewers and structures appurtenant thereto. Excavating, trenching, backfilling, and density tests are specified elsewhere. Sewage collection system work includes, but is not limited to, the following:

Sanitary sewer conduits

Manholes, frames, and covers

B. For sanitary sewer related construction on the project site, refer to the Standards and Specifications for Wastewater and Water Main Construction by Martin County Utilities, if more stringent than herein specified.

C. Refer to Division 02 Sections for excavation and backfilling work related to sewer collection systems.

D. Refer to Division 03 Sections for concrete work related to sewer collection systems.

1.3 QUALITY ASSURANCE

A. Installer: A firm specializing and experienced in sewer work for not less than two years.

B. Code Compliance: Comply with applicable portions of local plumbing codes, Martin County Utilities Standards and Specifications for Wastewater and Water Main Construction, and the Florida Department of Environmental Protection.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer’s technical data and installation instructions for each major component for the sewage collection system materials and products.

B. Record Drawings: At project close-out, submit drawings labeled as “Record Drawings” indicating all installed sewage collection system piping, manholes and products, signed and sealed by a Registered Land Surveyor (State of Florida) containing the following:

1. Location of each manhole. Location of each sewer service at connection. Invert elevations of building services at tie-in. Rim elevations, bottom elevations and invert elevation of all pipes entering manholes. Slope of each segment (mains & services). Length and location of all plugged stub outs. Type of materials used. All horizontal locations required on record drawings shall be located according to the project coordinate.

C. Maintenance Data: Submit maintenance data and parts lists for sewage collection system materials and products. Include this data, shop drawings, product data and record drawings in a maintenance manual to be presented to the Owner at project close-out.

PART 2 - PRODUCTS

2.1 CONDUIT MATERIALS

A. General: Furnish ells, tees, reducing tees, wyes, couplings, increased superior physical and chemical properties as acceptable to the Architect/Engineer.

B. Polyvinyl Chloride (PVC) Gravity Sanitary Sewer Pipe and Fittings: ASTM D-3034, Type PSM, SDR35.

1. Color: Green.

C. PVC Pipe Joints: Joints for PVC sewer pipe shall be rubber gasketed type complying in all

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respects to the physical requirements of ASTM D-3212 and ASTM F-477. Lubricant for jointing as approved by the pipe manufacturer shall be used for connecting PVC pipes.

2.2 CONCRETE MANHOLES

A. Precast manhole sections shall be minimum 5" thick and 48" in diameter, conforming to ASTM C-478. Cones shall have same wall thickness and reinforcement as manhole section. Top and bottom of all sections shall be parallel. Joints shall be tongue-and-groove or Keylock type. Joints shall be formed using an approved joint sealer.

1. Prior to the delivery of any size of precast section on the job site, yard tests will be conducted at the point of manufacture. The precast sections to be tested will be selected at random from the stockpiled material which is to be supplied for the job. All test specimens will be mat tested, and shall meet the permeability test requirements of ASTM C-14.

B. Coating System: All sanitary sewer manholes shall be provided with an interior and exterior coal tar epoxy coating. After the concrete has cured for 28 days, minimum, the precast units shall be coated by the manufacturer. The units shall be touched up in the field by the Contractor, if damaged. Interior and exterior surfaces of the manholes shall be coated in accordance with System A, B, or C below.

1. SYSTEM A (TNEMEC)
   a. Surface Preparation: SP-C2.
   b. Finish: 2 coats of Tnemec 413 Tneme-Tar at 8.3-mil dry thickness, 11.4 wet (140 SFPG) per coat. Thin first coat 10 percent. Apply second coat within 96 hours.
   c. Total Thickness (dry): 16.6-mil.
2. SYSTEM B (PORTER)
   a. Surface Preparation: SP-C2.
   b. Primer: 1 coat of Porter Tarset Concrete Primer at 4.0-mil dry thickness (260 SFPG).
   c. Finish: 2 coats of Porter 7013 Tarset C-200 Coal Tar Epoxy Black at 6.0-mil dry thickness (200 SFPG) per coat.
   d. Total Thickness (dry): 16-mil.
3. SYSTEM C (KOPPERS)
   a. Surface Preparation: SP-C2.
   b. Finish: 2 coats of Koppers Bitumastic 300M Water Epoxy at 8.0-mil dry thickness (200 SFPG) per coat.
   c. Total Thickness (dry): 16-mil.

C. Sewer Main Connection to Manholes: Manholes shall be provided with manufacturer installed rubber boots with stainless steel clamps for connection of gravity lines.

D. Manhole Joint Seals: Preformed plastic gaskets shall meet all requirements of Federal Spec. SS-S-00210.

E. Manhole Frames and Covers: Traffic-bearing cast iron of size and shape detailed on the drawings. Covers shall have the word "sewer" in 2" raised letters. Castings shall be tough, close-grained gray iron, sound, smooth, clean, free from blisters, blowholes, shrinkage, cold shuts, and all defects. Plane or grind bearing surfaces to ensure flat, true surfaces. Covers shall be true and seat within ring at all points.

F. Base Rock: Clean 3/4" gravel or crushed rock uniformly graded from coarse to fine conforming to requirements of FDOT specifications, 2013.

G. Concrete: All concrete work shall conform to the requirements of Section 03 30 00, Concrete Work.

H. Cleanouts: Provide as indicated, pipe extension to grade with brass ferrule and brass countersunk cleanout plug.

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1. Provide a 12-inch by 12-inch concrete collar, 6 inches thick around all exterior cleanouts.

2.3 LOCATION AND IDENTIFICATION

A. General: All PVC pipe 4 inches and larger shall have a #10 GA copper trace wire located directly above the line and terminate on a metal device accessible from the surface without excavation. In addition, plastic marker tape marked “SANITARY” shall be located no less than 2 feet directly above the gravity or force main. Owner’s representative shall field verify the tape and locator wire installations prior to backfilling the trench.

PART 3 - EXECUTION

3.1 INSTALLATION OF CONDUIT

A. General: All PVC sewer shall be installed in accordance with Uni-Bell, UNI-B-5.

B. Pipe Distribution: Distribute material on the job no faster than it can be used to good advantage. Unload pipe that cannot be physically lifted by workers from the trucks, by a forklift, or other approved means. Do not drop pipe of any size from the bed of the truck to the ground.

C. Pipe Preparation and Handling: Inspect all pipe and fittings prior to lowering into the trench to ensure no cracked, broken, or otherwise defective materials are being used. Clean ends of pipe thoroughly. Remove foreign matter and dirt from inside of pipe and keep clean during and after laying.

D. Use proper implements, tools, and facilities for the safe and proper protection of the work. Lower pipe into the trench in such a manner as to avoid any physical damage to the pipe. Remove all damaged pipe from the job site. Do not drop or dump pipe into trenches under any circumstances.

3.2 LINE AND GRADE

A. Gravity Sewer Pipe: All sewer lines between manholes shall be absolutely straight and true. No curvature shall be tolerated. Do not deviate from line or grade, as established by the Engineer, more than 1/2" for line and 1/4" for grade, provided that such variation does not result in a level or reverse sloping invert.

1. Establish line and grade for pipe by the use of lasers or by transferring the cut from offset stakes to batter boards set in the trench at maximum intervals of 25 feet. Maintain a minimum of three sets of batter boards with string line ahead of the pipe laying at all times.

B. Laying and Jointing Pipe: Pipe laying shall proceed upgrade with spigot ends pointing in direction of flow. After a section of pipe has been lowered into the prepared trench, clean the end of the pipe to be joined, the inside of the joint, and the rubber ring immediately before joining the pipe. Make assembly of the joint in accordance with the recommendations of the manufacturer of the type of joint used. Provide all special tools and appliances required for the jointing assembly.

1. After the joint has been made, check pipe for alignment and grade. The trench bottom shall form a continuous and uniform bearing and support for the pipe at every point between joints. Apply sufficient pressure in making the joint to assure that the joint is "home" as defined in the standard installation instructions provided by the pipe manufacturer. To assure proper pipe alignment and joint makeup, place sufficient pipe zone material to secure the pipe from movement before the next joint.

2. When pipe is laid within a movable trench shield, take necessary precautions to prevent pipe joints from pulling apart when moving the shield ahead.

3. Take the necessary precautions required to prevent excavated or other foreign material from getting into the pipe during the laying operation. At all times, when laying operations are not in progress, at the close of the day's work, or whenever the workers are absent from the job, close and block the open end of the last laid section of pipe to prevent entry of foreign material or creep of the gasketed joints.

4. Plug or close off pipes that are stubbed off for manhole construction or for construction by

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others, with temporary plugs.

5. Take all precautions necessary to prevent the "uplift" or floating of the line prior to the completion of the backfilling operation.

6. Where non-reinforced pipe is connected to manholes or concrete structures, make connection so that the standard pipe joint is located not more than 3 feet from the outside edge of the structure.

7. When cutting and/or machining the pipe is necessary, use only tools and methods recommended by the pipe manufacturer.

3.3 UNDERGROUND STRUCTURES

A. Rock Base: Prior to setting precast concrete base section, remove water from the excavation. Place a minimum of 6" of rock base and thoroughly compact with a mechanical vibrating or power tamper.

B. Manhole Joint Seals: Carefully inspect precast manhole sections to be joined. Sections with chips or cracks in the tongue shall not be used. Joint seals shall be installed in strict conformance with the manufacturer's recommendations.

C. Precast Concrete Manholes: Place precast concrete sections as shown on the drawings. Where manholes occur in pavements, set tops of frames and covers flush with finish surface. Elsewhere, set tops 3 inches above finish surface, unless otherwise indicated.

1. Install frames and covers on top of manholes to positively prevent all infiltration of surface or groundwater into manholes.

2. Frames shall be set in a bed of mortar with the mortar carried over the flange of the ring as shown in the Manhole Details on the drawings.

3. Provide rubber joint gasket complying with ASTM C-443.

4. Apply bituminous mastic coating at joints of sections.

D. Manhole Invert: Construct manhole inverts in conformance with details shown on the drawings and to ensure an unobstructed flow through manhole. Remove sharp edges or rough sections which tend to obstruct flow. Where a full section of pipe is laid through a manhole, break out the top section and cover exposed edge of pipe completely with mortar. Trowel all mortar surfaces smooth.

3.4 BACKFILLING

A. General: Conduct backfill operations of open-cut trenches closely following laying, jointing and bedding of pipe, and after initial inspection and testing are completed.

1. Place backfill and compact in accordance with provisions of Section 31 20 00, Earthwork.

2. During backfill operations over pipelines, install the continuous trace wire directly above the pipe at a depth of 6-inches below finish grade.

3.5 CLEANING AND TESTING OF GRAVITY SEWERS

A. Prior to final acceptance, the sewer collection system shall be thoroughly cleaned and visually inspected in the presence of the Engineer and local authorities. Visual inspection shall include closed circuit television inspection.

1. Closed circuit television inspection shall be in conformance with Section V, "Recommended Specifications for Sewer Collection System Rehabilitation" published by the National Association of Sewer Service Companies.

B. Following visual inspection, leakage testing shall be performed on all sewer lines and vacuum testing shall be performed on all sanitary structures.

C. Required methods of testing shall be as follows and the Contractor shall furnish all necessary tools, supplies, labor and equipment for testing.

1. Leakage testing of sewer lines shall be low pressure air exfiltration tests performed in

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accordance with Uni-Bell, UNI-B-6, and in accordance with the local authority or utility provider requirements.

2. Head pressure test (water) as required by the Florida Building Code – Eighth Edition (2023).

3. Vacuum testing of sanitary structures shall be in accordance with the local authority or utility provider requirements.

D. Visual inspection and testing shall be performed on the same day. Notify Engineer one week in advance.

E. Deflection Testing: Testing is required no sooner than 30 days after the final backfilling activities are completed on all sections of PVC piping. No section of pipe shall deflect more than 5% using a rigid ball or mandrel for the testing with a diameter not less than 95% of the base inside diameter of the pipe. Testing shall not be performed using mechanical pulling.

F. Contractor shall provide a sealed, certified survey of the as-built conditions including locations, pipe sizing, separation distances from other utilities at pipe crossings, and invert data for the entire sanitary system.

3.6 PLACING SYSTEM INTO SERVICE

A. General: The sewage collection system shall not be placed into service until all required testing has been completed, approved by the Engineer, and a “Clearance for Use” certification (if required) has been issued by the Florida Department of Environmental Protection.

END OF SECTION

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SECTION 33 41 00 - STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SCOPE

A. This section includes storm sewers and structures appurtenant thereto. Excavating, trenching, backfilling and density tests are specified elsewhere. Storm sewer system work includes, but is not limited to, the following:

1. Storm sewer conduits
2. Storm sewer structures required by drawings

B. Refer to applicable Division 02 sections for excavation and backfilling work related to storm sewer systems.

1.3 QUALITY ASSURANCE

A. Installer: A firm specializing and experienced in storm sewer work for not less than two years.

B. Code Compliance: Comply with applicable portions of local plumbing codes, the requirements of South Florida Water Management District and the Florida Department of Environmental Protection.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer’s technical data and installation instructions for each major component for the storm sewer system materials and products.

B. Record Drawings: At project closeout, submit record drawings of installed storm sewerage piping and products. All drawings must be labeled as “Record Drawings” and be signed and sealed by a Professional Land Surveyor licensed in the State of Florida. Drawings shall include as a minimum: horizontal locations, tied to project coordinate system, of all structures (area drains, catch basins, manholes, headwalls, etc.) and piping, rim elevations of all structures with invert elevations of all pipes entering structures, diameter and material of all piping, and the slope of each pipe segment. Verify all elements of drainage control structures, including rim elevations, elevation of slots, weirs and orifices, and invert elevation of all pipes entering structures. Refer to "Earthwork" Section 31 20 00 for record drawing requirements regarding grading, swales, lakes and drainage retention areas.

C. An electronic copy of the Record Drawing shall be provided to the Architect in AutoCADD format prior to final acceptance of the work.

D. Maintenance Data: Submit maintenance data and parts lists for storm sewer system materials and products. Include this data, shop drawings, product data and record drawings in a maintenance manual to be presented to the Owner at project close-out.

PART 2 - PRODUCTS

2.1 GENERAL

A. Except as otherwise provided, all off-site storm sewer materials shall comply with the applicable sections of Martin County Standards which are hereby incorporated into these specifications by reference. All on-site storm sewer materials shall comply with the specifications contained herein.

2.2 CONDUIT MATERIALS

A. Provide materials specified below:

1. Polyvinyl Chloride (PVC), ASTM D-3034, SDR 35 pipe and fittings. Joints and fittings shall have elastomeric gasket joints manufactured in accordance with ASTM D-3212 and ASTM D-477.

2. Round Reinforced Concrete Pipe (RCP) in accordance with ASTM C-76. Joints shall be bell and spigot type. The spigot end shall be grooved to accommodate a rubber O-ring gasket to provide a water tight seal conforming to the requirements of ASTM C-443.

3. Polypropylene Pipe (PPP), 12-inch to 60-inch, shall meet AASHTO M330 and ASTM F2881. Joints shall be bell and spigot, watertight, according to ASTM D3212. Gaskets shall meet the requirements of ASTM F477.

2.3 STORM SEWER STRUCTURES

A. Provide materials and perform all work in accordance with Section 425 of the referenced FDOT Standard Specifications.

B. Manhole Joint Seals: Preformed plastic gaskets shall meet all requirements of Federal Spec. SS-S-00210.

C. Manhole Frames and Covers: Traffic-bearing cast iron of size and shape detailed on the drawings. Covers shall have the word "STORM" in 2" raised letters. Castings shall be tough, close-grained gray iron, sound, smooth, clean, free from blisters, blowholes, shrinkage, cold shuts, and all defects. Plane or grind bearing surfaces to ensure flat, true surfaces. Covers shall be true and seat within ring at all points.

D. Catch Basin Frames and Grates: Use cast iron grates and cast-in angle iron seats on all catch basin structures. Grates in paved areas shall be traffic bearing.

E. Base Rock: Clean 3/4" gravel or crushed rock uniformly graded from coarse to fine conforming to requirements of FDOT specifications, 1996.

F. Concrete: All concrete work shall conform to the requirements of Section 03 30 00, Cast-In-Place Concrete.

G. Cleanouts: Provide as indicated, pipe extension to grade with brass ferrule and brass countersunk cleanout plug.

1. Provide a 12-inch by 12-inch concrete collar, 6 inches thick around all exterior cleanouts.

PART 3 - EXECUTION

3.1 GENERAL

A. General: All construction operations shall adhere to the requirements of the referenced FDOT Standard Specifications.

B. Conform to manufacturer's recommendations on the installation of RCP, PVC, and PPP storm sewers.

C. Pipe Distribution: Distribute material on the job no faster than it can be used to good advantage. Unload pipe which cannot be physically lifted by workers from the trucks, by a forklift, or other approved means. Do not drop pipe of any size from the bed of the truck to the ground.

D. Pipe Preparation and Handling: Inspect all pipe and fittings prior to lowering into trench to ensure no cracked, broken, or otherwise defective materials are being used. Clean ends of pipe thoroughly. Remove foreign matter and dirt from inside of pipe and keep clean during and after installation.

E. Use proper implements, tools, and facilities for the safe and proper protection of the work. Lower pipe into the trench in such a manner as to avoid any physical damage to the pipe. Remove all damaged pipe from the job site. Do not drop or dump pipe into trenches under any circumstances.

3.2 LINE AND GRADE

A. General: All sewer lines between structures shall be absolutely straight and true. No curvature shall be tolerated. Do not deviate from line or grade more than 1/2" for line and 1/4" for grade, provided that such variation does not result in a level or reverse sloping invert.

1. Establish line and grade for pipe by the use of lasers or by transferring the cut from offset stakes to batter boards set in the trench at maximum intervals of 25 feet. Maintain a

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minimum of three sets of batter boards with string line ahead of the pipe laying at all times.

B. Laying and Jointing Pipe: Pipe laying shall proceed upgrade with spigot ends pointing in direction of flow. After a section of pipe has been lowered into the prepared trench, clean the end of the pipe to be joined and the inside of the joint immediately before joining the pipe. Make assembly of the joint in accordance with the recommendations of the manufacturer of the type of joint used. Provide all special tools and appliances required for the jointing assembly.

1. After the joint has been made, check pipe for alignment and grade. The trench bottom shall form a continuous and uniform bearing and support for the pipe at every point between joints. Apply sufficient pressure in making the joint to assure that the joint is "home" as defined in the standard installation instructions provided by the pipe manufacturer. To assure proper pipe alignment and joint makeup, place sufficient pipe zone material to secure the pipe from movement before the next joint is installed.
2. When pipe is laid within a movable trench shield, take necessary precautions to prevent pipe joints from pulling apart when moving the shield ahead.
3. Take the necessary precautions required to prevent excavated or other foreign material from getting into the pipe during the laying operation. At all times, when laying operations are not in progress, at the close of the day's work, or whenever the workers are absent from the job, close and block the open end of the last laid section of pipe to prevent entry of foreign material or creep of the joints.
4. Plug or close off pipes which are stubbed off for structure construction or for construction by others, with temporary plugs.
5. Take all precautions necessary to prevent the "uplift" or floating of the line prior to the completion of the backfilling operation.
6. Where non-reinforced pipe is connected to manholes or concrete structures, take connection so that the standard pipe joint is located not more than 3 feet from the outside edge of the structure.
7. When cutting and/or machining the pipe is necessary, use only tools and methods recommended by the pipe manufacturer.

3.3 UNDERGROUND STRUCTURES

A. Rock Base: Prior to setting pre-cast concrete base section, remove water from the excavation. Place a minimum of 6" of rock base and thoroughly compact with a mechanical vibrating or power tamper.

B. Structure Joint Seals: Carefully inspect pre-cast structure sections to be joined. Sections with chips or cracks in the tongue shall not be used. Joint seals shall be installed in strict conformance with the manufacturer's recommendations. Only pipe primer furnished by the joint seal manufacturer will be approved.

C. Pre-cast Concrete Structures: Place pre-cast concrete sections as shown on the drawings. Set top elevation of catch basins as indicated on the drawings. Where manholes occur in pavements, set tops of frames and covers flush with finish surface. Elsewhere, set manhole tops 3 inches above finish surface, unless otherwise indicated.

1. Install frames and covers on top of manholes to positively prevent all infiltration of surface or groundwater into manholes.
2. Frames shall be set in a bed of mortar with the mortar carried over the flange of the ring as shown in the Manhole Details on the drawings.
3. Provide rubber joint gasket complying with ASTM C-443.
4. Apply bituminous mastic coating at joints of sections.

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D. Manhole Invert: Construct manhole inverts in conformance with details shown on the drawings and to ensure an unobstructed flow through manhole. Remove sharp edges or rough sections which tend to obstruct flow. Trowel all mortar surfaces smooth.

3.4 BACKFILLING

A. General: Conduct backfill operations of open-cut trenches closely following laying, jointing and bedding of pipe, and after initial inspection and testing are completed. Place backfill and compact in accordance with provisions of Section 31 20 00, Earthwork.

3.5 CLEANING AND TESTING

A. Prior to final acceptance, the storm sewer system shall be thoroughly cleaned and visually inspected in the presence of the Engineer or his designated representative. Visual inspection shall include closed circuit television (video) inspection.

1. Closed circuit television (video) inspection shall be in conformance with Section V, "Recommended Specifications for Sewer Collection System Rehabilitation" published by the National Association of Sewer Service Companies.

B. Following visual inspection and video inspection, leakage testing shall be required.

C. Acceptable methods of testing shall be water in accordance with the Florida Building Code – Eighth Edition (2023) requirements.

D. The Contractor shall furnish all necessary tools, supplies, labor and equipment for testing.

E. Visual inspection and testing shall be performed on the same day. Notify the Engineer one week in advance.

F. Contractor shall provide a sealed, certified survey of the as-built layout of the storm system including structure locations, inverts, pipe sizes, locations and inverts and detailed information on the storm water management pond areas.

END OF SECTION

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