

Project Manual

March 24, 2025



**Marketplace at Kanner
3301 Kanner Hwy
Stuart FL**



Prepared By: AS



**BDG Project Name: FIFTH THIRD, Marketplace at Kanner
BDG Project Number: 230651**

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SECTION 014100 - SPECIAL INSPECTIONS

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. This Section includes administrative and procedural requirements required for compliance with the International Building Code, Chapter 17, Structural Tests and Special Inspections.
- B. Structural testing and special inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve contractor of responsibility for compliance with other construction 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 Contractor's other quality-assurance and -control procedures that facilitate compliance with the construction document requirements.
 - 3. Requirements for contractor to provide quality-assurance and -control services required by architect, owner, or authorities having jurisdiction are not limited by provisions of this section.
- C. The owner will engage one or more qualified special inspectors and / or testing agencies to conduct structural tests and special inspections specified in this section and related sections and as maybe specified in other divisions of these specifications.
- D. Related Sections include but are not limited to the following:
 - 1. 03 30 00 CAST-IN-PLACE CONCRETE.
 - 2. 05 12 00 STRUCTURAL STEEL.
 - 3. 05 31 00 STEEL DECKING.
 - 4. 31 20 00 EARTH MOVING.
 - 5. 32 13 13 CONCRETE PAVING.

1.3 DEFINITIONS

- A. Approved Agency: An established and recognized agency regularly engaged in conducting tests or furnishing inspection services, when such agency has been approved by the building official.
- B. Construction Documents: Written, graphic and pictorial documents prepared or assembled for describing the design, location and physical characteristics of the elements of a project necessary for obtaining a building permit. Construction Documents include all supplemental

instructions, sketches, addenda, and revisions to the drawings and specifications issued by the registered design professional beyond those issued for a building permit.

- C. Shop Drawings / Submittal Data: Written, graphic and pictorial documents prepared and / or assembled by the contractor based on the Construction Documents.
- D. Structural Observation: Visual observation of the structural system by a representative of the registered design professional's office for general conformance to the approved construction documents. Structural observations are not considered part of the structural tests and special inspections and do not replace inspections and testing by the testing agency or special inspector.
- E. Special Inspector: A qualified person who demonstrating competence, to the satisfaction of the code enforcement official and registered design professional in responsible charge, for inspection of the particular type of construction or operation requiring special inspection. The special inspector shall be a licensed professional engineer or engineering intern or a qualified representative from the testing agency.
- F. Special Inspection, Continuous: The full-time observation of work requiring special inspection by an approved special inspector who is present in the area where the work is being performed.
- G. Special Inspection, Periodic: The part-time or intermittent observation of work requiring special inspection by an approved special inspector who is present in the area where the work has been or is being performed and at the completion of the work.
- H. Testing Agency: A qualified materials testing laboratory under the responsible charge of a licensed professional engineer, approved by the code enforcement official and the registered design professional in responsible charge, to measure, examine, test, calibrate, or otherwise determine the characteristics or performance of construction materials and verify confirmation with construction documents.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications:
 - 1. Minimum qualifications of inspection and testing agencies and their personnel shall comply with ASTM E329-03 Standard Specification for Agencies in the Testing and / or Inspection of Materials Used in Construction.
 - a. Inspectors and individuals performing tests shall be certified for the work being performed as outlined in the appendix of the ASTM E329. Certification by organizations other than those listed must be submitted to the building official for consideration before proceeding with work.
 - 2. In addition to these requirements, local jurisdiction may have additional requirements. It is the responsibility of the testing and inspection agencies to meet local requirements and comply with local procedures.

1.5 CONFLICTING REQUIREMENTS, REPORTS, AND TEST RESULTS

- A. General: 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 uncertainties and requirements that are different, but apparently equal, to the registered design professional in responsible charge 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 the registered design profession in responsible charge for a decision before proceeding.
- C. The special inspector's reports and testing agencies results shall have precedence over reports and test results provided by the contractor.
- D. Where a conflict exists between the construction documents and approved shop drawings / submittal data, the construction documents shall govern unless the shop drawings / submittal data are more restrictive. All conflicts shall be brought to the attention of the registered design professional in responsible charge.

1.6 SUBMITTALS BY SPECIAL INSPECTOR AND / OR TESTING AGENCY

- A. Special inspectors shall keep and distribute records of inspections. The special inspector shall furnish inspection reports to the building official, and to the registered design professional in responsible charge, contractor, architect, and owner. Reports shall indicate that work inspected was done in conformance to approved construction documents. Discrepancies shall be brought to the immediate attention of the contractor for correction. If the discrepancies are not corrected, the discrepancies shall be brought to the attention of the building official and to the registered design professional in responsible charge prior to the completion of that phase of the work. A final report documenting required special inspections and correction of any discrepancies noted in the inspections shall be submitted at a point in time agreed upon by the permit applicant and the building official prior to the start of work.
 - 1. Special inspection reports and test results shall include, but not be limited to, the following:
 - a. Date of inspection.
 - b. Description of inspections or tests performed including location (reference grid lines, floors, elevations, etc.).
 - c. Statement noting that the work, material, and / or product conforms or does not conform to the construction document requirements.
 - 1) Name and signature of contractor's representative who was notified of work, material, and / or products that do not meet the construction document requirements.
 - d. Name and signature of special inspector and / or testing agency representative performing the work.
- B. Schedule of Non-Compliant Work: Each agent shall maintain a log of work that does not meet the requirements of the construction documents. Include reference to original inspection / test report and subsequent dates of re-inspection / retesting.
- C. Reports and tests shall be submitted within 1 week of inspection or test. Schedule of Non-Compliant Work shall be updated daily and submitted at monthly intervals.
- D. Final Report of Special Inspections. Submitted by each agent listed in the schedule of Structural Testing and Special Inspections.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION

3.1 CONTRACTOR'S RESPONSIBILITY

- A. The contractor shall coordinate the inspection and testing services with the progress of the work. The contractor shall provide sufficient notice to allow proper scheduling of all personnel. The contractor shall provide safe access for performing inspection and on site testing.
- B. The contractor shall submit schedules to the owner, registered design professionals and testing and inspecting agencies. Schedules will note milestones and durations of time for materials requiring structural tests and special inspections.
- C. Each contractor responsible for the construction of a seismic-force-resisting system, designated seismic system, or component listed in the quality assurance plan shall submit a written contractor's statement of responsibility to the building official and to the owner prior to the commencement of work on the system or component. The contractor's statement of responsibility shall contain the following:
 - 1. Acknowledgment of awareness of the special requirements contained in the quality assurance plan.
 - 2. Acknowledgment that control will be exercised to obtain conformance with the construction documents approved by the building official.
 - 3. Procedures for exercising control within the contractor's organization, the method and frequency of reporting and the distribution of the reports.
 - 4. Identification and qualifications of the person(s) exercising such control and their position(s) in the organization.
- D. Each contractor responsible for the construction of a main windforce-resisting system or a wind-resisting component listed in the quality assurance plan shall submit a written statement of responsibility to the building official and the owner prior to the commencement of work on the system or component. The contractor's statement of responsibility shall contain the following:
 - 1. Acknowledgment of awareness of the special requirements contained in the quality assurance plan.
 - 2. Acknowledgment that control will be exercised to obtain conformance with the construction documents approved by the building official.
 - 3. Procedures for exercising control within the contractor's organization, the method and frequency of reporting and the distribution of the reports.
 - 4. Identification and qualifications of the person(s) exercising such control and their position(s) in the organization.
- E. The contractor shall repair and / or replace work that does not meet the requirements of the construction documents.
 - 1. Contractor shall engage an engineer / architect to prepare repair and / or replacement procedures.
 - 2. Engineer / architect shall be registered in the state in which the project is located. Engineer shall be acceptable to the registered design professional in responsible charge, code enforcement official, and owner.
 - 3. Procedures shall be submitted for review and acceptance by the registered design professional in responsible charge, code enforcement official, and owner before proceeding with corrective action.
- F. The contractor shall be responsible for costs of:

1. Re-testing and re-inspection of materials, work, and / or products that do not meet the requirements of the construction documents and shop drawings / submittal data.
2. Review of proposed repair and / or replacement procedures by the registered design professional in responsible charge and the inspectors and testing agencies.
3. Repair or replacement of work that does not meet the requirements of the construction documents.

3.2 STRUCTURAL OBSERVATIONS

- A. Structural observations may be made periodically as determined by the registered design professional in responsible charge.

3.3 TESTING AND INSPECTION

- A. Testing and inspection shall be in accordance with the Schedule of Special Inspections found on the construction documents.
- B. Reference related specifications for the minimum level of inspections and testing. Provide additional inspections and testing as necessary to determine compliance with the construction drawings.

PART 4 - SCHEDULES AND FORMS (ATTACHED)

4.1 STATEMENT OF SPECIAL INSPECTIONS.

4.2 FINAL REPORT OF SPECIAL INSPECTIONS.

END OF SECTION 014100

STATEMENT OF SPECIAL INSPECTIONS

Project: Fifth Third Bank

Project Address:

Permit Applicant:

Applicant Address:

Owner: Fifth Third Bank

Owner Address:

Registered Design Professionals (RDP):

Architect:

Geotechnical Engineer:

Structural Engineer:

Mechanical Engineer:

Electrical Engineer:

This statement of special inspections is submitted as a condition for permit issuance in accordance with Chapter 17 of the International Building Code. It includes a *Schedule of Special Inspections* applicable to the above referenced project as well as the identity of the individuals, agencies, or firms intended to be retained for conducting these inspections.

The Special Inspector(s) shall keep records of all inspections and shall furnish interim inspection reports to the registered design professional in responsible charge at a frequency agreed upon by the permit applicant and engineer prior to the start of work. Discrepancies shall be brought to the immediate attention of the contractor for correction. If the discrepancies are not corrected, the discrepancies shall be brought to the attention of the registered design professional in responsible charge prior to completion of that phase of work. A *Final Report of Special Inspections* documenting required special inspections and correction of any discrepancies noted in the inspections shall be submitted by each agent at the completion of that phase of work.

Maximum frequency of interim report submittals shall not be less than_____.

The Special Inspection program does not relieve the contractor of the responsibility to comply with the Contract Documents. Jobsite safety and means and methods of construction are solely the responsibility of the Contractor.

Owner's Acknowledgement:

Signature

Date

Building Official's Acceptance:

Signature

Date

Permit No.

Frequency of interim report submittals to building official:

FINAL REPORT OF SPECIAL INSPECTIONS

Project: Fifth Third Bank

Project Address:

Testing / Inspection Agent:

Testing / Inspection Agent Address:

Scope of Testing / Inspections:

(To be completed by Testing / Inspection Agent)

To the best of my information, knowledge, and belief, the special inspections or testing required for this project, and designated for this Agent in the *Schedule of Special Inspections* submitted for permit, have been completed in accordance with the contract documents.

Interim reports submitted prior to this final report and numbered to , form a basis for, and are to be considered an integral part of this final report. The following discrepancies that were outstanding since the last interim report dated have been corrected:

(Attach 8 1/2" x 11" continuation sheet(s) if required to complete the description of corrections)

Prepared By:

Type or print name

Signature

Date

Special Inspector's Seal

(Licensed Professional Engineer)

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

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 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Salvaging nonhazardous demolition and construction waste.
 - 2. Recycling nonhazardous demolition and construction waste.
 - 3. Disposing of nonhazardous demolition and construction waste.
- B. Related Requirements:
 - 1. Section 011200 "Multiple Contract Summary" for coordination of responsibilities for waste management.
 - 2. Section 024116 "Structure Demolition" for disposition of waste resulting from demolition of buildings, structures, and site improvements, and for disposition of hazardous waste.
 - 3. Section 024119 "Selective Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements, and for disposition of hazardous waste.
 - 4. Section 042000 "Unit Masonry" for disposal requirements for masonry waste.
 - 5. Section 044313.13 "Anchored Stone Masonry Veneer" for disposal requirements for excess stone and stone waste.
 - 6. Section 044313.16 "Adhered Stone Masonry Veneer" for disposal requirements for excess stone and stone waste.
 - 7. Section 311000 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- C. 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.

- D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Achieve end-of-Project rates for salvage/recycling of 75 percent by weight of total non-hazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials, including the following:

- 1. Demolition Waste:

- a. Asphalt paving.
- b. Concrete.
- c. Concrete reinforcing steel.
- d. Brick.
- e. Concrete masonry units.
- f. Wood studs.
- g. Wood joists.
- h. Plywood and oriented strand board.
- i. Wood paneling.
- j. Wood trim.
- k. Structural and miscellaneous steel.
- l. Rough hardware.
- m. Roofing.
- n. Insulation.
- o. Doors and frames.
- p. Door hardware.
- q. Windows.
- r. Glazing.
- s. Metal studs.
- t. Gypsum board.
- u. Acoustical tile and panels.
- v. Carpet.
- w. Carpet pad.
- x. Demountable partitions.
- y. Equipment.
- z. Cabinets.
- aa. Plumbing fixtures.
- bb. Piping.
- cc. Supports and hangers.
- dd. Valves.
- ee. Sprinklers.

- ff. Mechanical equipment.
- gg. Refrigerants.
- hh. Electrical conduit.
- ii. Copper wiring.
- jj. Lighting fixtures.
- kk. Lamps.
- ll. Ballasts.
- mm. Electrical devices.
- nn. Switchgear and panelboards.
- oo. Transformers.

2. Construction Waste:

- a. Masonry and CMU.
- b. Lumber.
- c. Wood sheet materials.
- d. Wood trim.
- e. Metals.
- f. Roofing.
- g. Insulation.
- h. Carpet and pad.
- i. Gypsum board.
- j. Piping.
- k. Electrical conduit.
- l. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:
 - 1) Paper.
 - 2) Cardboard.
 - 3) Boxes.
 - 4) Plastic sheet and film.
 - 5) Polystyrene packaging.
 - 6) Wood crates.
 - 7) Plastic pails.

1.5 ACTION SUBMITTALS

- A. Waste Management Plan: Submit plan within 7 days of date established for the Notice of Award.

1.6 INFORMATIONAL SUBMITTALS

- A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Use Form CWM-7 for construction waste and Form CWM-8 for demolition waste. Include the following information:
 - 1. Material category.
 - 2. Generation point of waste.

3. Total quantity of waste in **tons** (tonnes).
 4. Quantity of waste salvaged, both estimated and actual in **tons** (tonnes).
 5. Quantity of waste recycled, both estimated and actual in **tons** (tonnes).
 6. Total quantity of waste recovered (salvaged plus recycled) in **tons** (tonnes).
 7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
- B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- G. Qualification Data: For waste management coordinator and refrigerant recovery technician.
- 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.
- 1.7 QUALITY ASSURANCE
- A. Waste Management Coordinator Qualifications: Experienced firm, with a record of successful waste management coordination of projects with similar requirements.
- B. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.
- C. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
- D. Waste Management Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:
1. Review and discuss waste management plan including responsibilities of waste management coordinator.
 2. Review requirements for documenting quantities of each type of waste and its disposition.

3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
5. Review waste management requirements for each trade.

1.8 WASTE MANAGEMENT PLAN

- A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of demolition site-clearing and construction waste generated by the Work. Use [Form CWM-1 for construction waste and Form CWM-2 for demolition waste. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Use Form CWM-3 for construction waste and Form CWM-4 for demolition waste. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
 1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
 2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
 3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
 4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
 5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
 6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.
- D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Use Form CWM-5 for construction waste and Form CWM-6 for demolition waste. Include the following:
 1. Total quantity of waste.
 2. Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers for each type of waste.
 3. Total cost of disposal (with no waste management).
 4. Revenue from salvaged materials.
 5. Revenue from recycled materials.
 6. Savings in hauling and tipping fees by donating materials.

7. Savings in hauling and tipping fees that are avoided.
8. Handling and transportation costs. Include cost of collection containers for each type of waste.
9. Net additional cost or net savings from waste management plan.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

- A. General: 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 015000 "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. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.
 1. Distribute waste management plan to everyone concerned within 3 days of submittal return.
 2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
 2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION WASTE

- A. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:
 1. Clean salvaged items.
 2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
 3. Store items in a secure area until installation.
 4. Protect items from damage during transport and storage.

5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.
- B. Salvaged Items coordinate with project manager to verify items can be stored on Project site.
- C. Salvaged Items for Owner's Use: Salvage items for Owner's use and handle as follows:
 1. Clean salvaged items.
 2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
 3. Store items in a secure area until delivery to Owner.
 4. Transport items to Owner's storage area designated by Owner.
 5. Protect items from damage during transport and storage.
- D. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.
- E. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.
- F. Plumbing Fixtures: Separate by type and size.
- G. Lighting Fixtures: Separate lamps by type and protect from breakage.
- H. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

3.3 RECYCLING [DEMOLITION] [AND] [CONSTRUCTION] WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Receivers and Processors: available recycling receivers and processors include, but are not limited to, the following:
 1. Those selected by contractor or as directed by owner.
- C. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall be coordinated with owner prior to demolition work commencement.
- D. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.
- E. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
 1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.

- a. Inspect containers and bins for contamination and remove contaminated materials if found.
2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

3.4 RECYCLING DEMOLITION WASTE

- A. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.
- B. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
 1. Pulverize concrete to maximum 1-1/2-inch (38-mm) 4-inch (100-mm) size.
 2. Crush concrete and screen to comply with requirements in Section 312000 "Earth Moving" for use as satisfactory soil for fill or subbase.
- C. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
 1. Pulverize masonry to maximum 1-inch (25-mm) size.
 - a. Crush masonry and screen to comply with requirements in Section 312000 "Earth Moving" for use as general fill.
 - b. Crush masonry and screen to comply with requirements in Section 329300 "Plants" for use as mineral mulch.
 2. Clean and stack undamaged, whole masonry units on wood pallets.
- D. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.
- E. Metals: Separate metals by type.
 1. Structural Steel: Stack members according to size, type of member, and length.
 2. Remove and dispose of bolts, nuts, washers, and other rough hardware.
- F. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.
- G. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.
- H. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.

- I. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.
- J. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
 - 1. Store clean, dry carpet and pad in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.
- K. Carpet Tile: Remove debris, trash, and adhesive.
 - 1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.
- L. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.
- M. Conduit: Reduce conduit to straight lengths and store by type and size.

3.5 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
 - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
 - 2. Polystyrene Packaging: Separate and bag materials.
 - 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
 - 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- B. Wood Materials:
 - 1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
 - 2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
 - a. Comply with requirements in Section 329300 "Plants" for use of clean sawdust as organic mulch.
- C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.
 - 1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.
 - a. Comply with requirements in Section 329300 "Plants" for use of clean ground gypsum board as inorganic soil amendment.

3.6 DISPOSAL OF WASTE

- A. General: 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. Burning: Burning of waste materials is permitted only at designated areas on Owner's property, provided required permits are obtained. Provide full-time monitoring for burning materials until fires are extinguished.
- D. Disposal: Remove waste materials and dispose of at designated spoil areas on Owner's property.
- E. Disposal: Remove waste materials from Owner's property and legally dispose of them.

3.7 ATTACHMENTS

- A. Form CWM-1 for construction waste identification.
- B. Form CWM-2 for demolition waste identification.
- C. Form CWM-3 for construction waste reduction work plan.
- D. Form CWM-4 for demolition waste reduction work plan.
- E. Form CWM-5 cost/revenue analysis of construction waste reduction work plan.
- F. Form CWM-6 cost/revenue analysis of demolition waste reduction work plan.
- G. Form CWM-7 for construction waste
- H. Form CWM-8 for demolition waste.

END OF SECTION 017419

SECTION 019113 - GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes the general requirements that apply to the implementation of the commissioning process for this project. Commissioning (Cx) is a quality oriented process for achieving, verifying, and documenting that the performance of the facilities, systems and assemblies meet defined objectives and criteria.
- B. The commissioning process does not limit the responsibilities of the Contractor or Engineer to provide a fully functional facility.
- C. Related Sections
 - 1. Division 22 Plumbing
 - 2. Division 23 Mechanical
 - 3. Division 26 Electrical

1.2 REFERENCE

- A. ASHRAE Guideline 0 2005
- B. USGBC – Leadership in Energy & Environmental Design version 3.0.

1.3 DESCRIPTION

- A. The commissioning process is based on ASHRAE Guideline 0 and LEED 3.0.
- B. Installations are inspected at various stages of construction and systems are functionally tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, safety modes, power failure, etc.
- C. Components are verified and documented to be installed and responding in accordance with Owner requirements and contract documents.
- D. Functional test are executed after installation verification checklists and start-ups are complete.
- E. The Commissioning plan describes the typical Cx responsibilities for the Cx Team. They include:
 - 1. Cx Team:
 - a. Participate in the Cx process.
 - b. Attend Cx kick-off meeting and other Cx Team meetings.
 - c. Review Cx Plan and FPT procedures developed by CxA.
 - 2. Cx Authority
 - a. Direct the Cx process
 - b. Provide Cx Plan, Pre-functional Checklists (PFC), Functional Performance Tests (FPT), action item list and final Cx report.
 - c. Lead the Cx Team meetings
 - d. Assist with the development of the Cx schedule.
 - e. Perform field visits and document installation
 - 3. Contractor:
 - a. Include requirements for Cx activities in each subcontract.

- b. Submit copy of approved submittals with startup, operating and maintenance criteria to CxA.
 - c. Facilitate coordination of Cx activities.
 - d. Manage Cx communication with sub-contractors.
 - e. Incorporate Cx activities including FPT into master construction schedule.
 - f. Manage the completion, submission, and review of PFC documentation. Forward completed PFC to CxA at least 10 workdays prior to scheduled FPT date.
 - g. Ensure corrective actions are taken for deficiencies, punchlist, and other identified action items.
 - h. Document responses and corrective actions for Cx action items and punchlist.
 - i. Incorporate durations into construction schedule per each system completion to administer FPT.
 - j. Submit detailed training plan to A/E for approval and CxA for comment.
 - k. Provide CxA with required documentation from Cx activities and submittal request.
 - l. Schedule, coordinate and assist CxA in seasonal or deferred testing and deficiency corrections required by specifications.
4. Sub-contractors:
- a. Assist with the development of the Cx schedule.
 - b. Complete and sign PFC in cooperation with the Contractor and submit with supporting documentation. Provide individuals or manufacturer's representatives with specific knowledge of completion of work.
 - c. Ensure installation work is complete, is in compliance with Contract Documents, PFC are complete and systems are ready for FPT.
 - d. Provide certified and calibrated instrumentation required to take measurements of system and equipment performance during FPT.
 - e. Execute inspections, tests, and FPT as described in contract documents and Cx Plan. Demonstrate and manipulate systems and equipment to show proper operation.
 - f. Provide documents such as trending, calibrations, testing, history, start-up, flushing, installation, etc. as needed for CxA review and documentation.

F. Systems included in Cx scope:

- 1. HVAC Systems
 - a. Air Handlers
 - b. Terminal Units
 - c. Exhaust Fans
 - d. Building Automation & Controls System
 - e. Misc. HVAC systems
- 2. Plumbing Systems
 - a. Domestic Hot Water System
- 3. Electrical
 - a. Lighting
 - b. Lighting Control Systems

1.4 DEFINITIONS

- A. Acceptance Phase – Phase during which functional testing is documented.
- B. Action Items – Items identified by CxA during construction that require contractor response.
- C. BOD - Basis of Design documents the design criteria and decisions made to meet design intent. Describes systems, components, conditions, and methods chosen to define the intent of the Owner.
- D. BAS – Building Automation System
- E. Construction Phase – Installation of systems prior to functional testing.
- F. Cx A - Cx Authority is the consultant who facilitates the Cx program and directs and coordinates day-to-day Cx activities. .
- G. Cx Plan - A manual providing documentation of roles and responsibilities and provides structured means of scheduling, coordination and documentation for the Cx process.
- H. Cx Team – The Cx A, Contractor, sub-contractor, and Owner.
- I. Deficiency: Condition of a component, piece of equipment, or system that is not in compliance with Contract Documents.
- J. FPT - Functional Performance Tests documents the dynamic function and operation of equipment and systems.
- K. Indirect Indicator: Indicator of a response or condition by a secondary intangible method, such as a reading from a control system graphical interface reporting some device to be in some state.
- L. OPR – Owner's Project Requirements documents the project expectations of the Owner.
- M. PFC - Prefunctional Checklists is the list of items to inspect and elementary component tests that verify proper installation of equipment. The primary purpose of the PFC is to document static inspections and procedures prior to initial operation (e.g., belt tension, oil levels, labels affixed, gages in place, sensors calibrated, etc.). It is a coordinated document representing the efforts of the subcontractors.
- N. Systems Manual – An Owner focused document for operating and maintaining the commissioned systems throughout the life of the facility. The Systems Manual is intended to be a usable information resource containing all of the information related to the systems, assemblies, and Commissioning Process in one place with indexes and cross references.
- O. TAB – Test, Adjust and Balance.
- P. Trending: Monitoring and recording controls points of systems as a function of time using building control system.
- Q. Warranty Phase – Post construction. (typically for one year)

1.5 SUBMITTALS

- A. Completed PFC
 - 1. Submit an executed PFC for each piece of equipment/system to be commissioned.
 - 2. Transmit completed PFC to the CxA to document request for functional testing to begin.

- B. Provide upon request, documentation such as manufacturer and model number, manufacturer's printed installation and detailed start-up procedures, full sequences of operation, O&M data, performance data, any performance test procedures, control drawings, and details of Owner contracted tests.

1.6 QUALITY ASSURANCE

- A. During Construction and Acceptance Phase:
 - 1. Coordinate Cx activities with the Cx Team
 - 2. Confirm equipment installation and start up is completed prior to functional testing.
 - 3. Ensure PFC are completed prior to functional testing
 - 4. Demonstrate FPT with, and to the satisfaction of CxA.
 - 5. Manage and correct deficiencies
 - 6. Performs FPT retests as needed to verify correction of any deficiencies
- B. Review the Cx Plan the plan for responsibilities and expectations during the Cx process.
- C. Attend Cx meetings throughout the Cx process.

1.7 SYSTEM STARTUP

- A. Start equipment according to manufactures recommendation.
- B. Document system start up time and date.
- C. Document person(s) performing startup.
- D. Provide vendor specific start up documentation.

1.8 SCHEDULING

- A. Coordinate and communicate commissioning activities with Owner, and CxA. Commissioning milestones include, but are not limited to:
 - 1. In-ground infrastructure inspections (i.e. grounding)
 - 2. Roof on
 - 3. Permanent power on
 - 4. Generator testing
 - 5. Permanent domestic water on
 - 6. Permanent chilled water on
 - 7. Duct pressure test
 - 8. Pipe pressure test
 - 9. HVAC start up
 - 10. TAB completion
- B. Coordinate and communicate other activities such as inspections, meetings, and schedule changes to the CxA.
- C. Ensure commissioning activities are incorporated into project schedule. Coordinate with CxA.

PART 2 - PRODUCTS

1.9 TEST EQUIPMENT

- A. Provide all specialized tools, test equipment, and instruments required to execute startup, checkout, and FPT of systems and equipment being commissioned.
- B. Test equipment shall be of sufficient quality and accuracy to test and/or measure system performance according to specified tolerances and have calibrated per the respective specifications.

PART 3 - EXECUTION

1.10 EXAMINATION

- A. Prior to start of any work, check, verify, and coordinate work with Cx Plan, drawings and specifications.
- B. Promptly request clarification and instruction or report any conflicts, inadequate conditions or missing information in the Cx documents.
- C. Respond to action items and field reports as noted by CxA.

1.11 FIELD QUALITY CONTROL

- A. Prefunctional Checks:
 - 1. Complete PFC to document systems are installed according to contract documents.
 - 2. Conduct a complete performance test for all systems to assure compliance with the contract documents.
 - a. Any components on systems found defective or not performing satisfactorily shall be readjusted and retested after necessary corrective measures are performed.
 - b. Corrective measures may include modification or addition of equipment and devices, control strategies and/or software program.
 - 3. Submit PFC prior to formal demonstration of FPT.
 - 4. Schedule demonstration of FPT with Cx at least 10 days in advanced.
- B. Repair, reprogram or replace any equipment or work that fails test.
- C. Respond to, and take corrective action on deficiency items or non-conformance issues noted and reported to Cx team as an action list or punch list item.
- D. Notify and coordinate with CxA, observation of field test such as duct pressure test, pipe pressure testing, flushing, etc.

1.12 DEMONSTRATION

- A. Coordinate FPT activities.
- B. Provide competent person (vendor or manufactures representative) to demonstrate functional performance of each system being commissioned.
- C. Utilizing CxA provided FPT, demonstrate to the CxA, the operation of each system being commissioned.
 - 1. Take actions as needed, to expedite testing and minimize unnecessary delays, while not compromising integrity of procedures.

2. Post date for completion of resolution of deficiency.
- D. Coordination and Scheduling:
1. Integrate Cx activities into the project construction schedule. Include milestone deadlines for completion of PFC and durations for FPT of each system.
 2. CxA will witness and document FPT of systems which as demonstrated by the Contractor or its sub contractor. Designated sub-contractor or vendor responsible for dynamic operation of a system or device shall demonstrate system functionality to CxA.
- E. Manage discrepancies, punchlist, action items, etc. identified during the Cx process.

END OF SECTION 019113

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.
- B. Related Requirements:
 - 1. Section 312000 "Earth Moving" for drainage fill under slabs-on-grade.
 - 2. Section 321313 "Concrete Paving" for concrete pavement and walks.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. **Product Data:** For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. **Product Certificates:** For materials manufactured within **100 miles** of Project, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each raw material.
 - 3. **Laboratory Test Reports:** For liquid floor treatments and curing and sealing compounds, indicating compliance with requirements for low-emitting materials.
- C. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- D. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar

diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

- E. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

- 1. Location of construction joints is subject to approval of the Architect.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, manufacturer, testing agency.

- B. Welding certificates.

- C. Material Certificates: For each of the following, signed by manufacturers:

- 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Steel reinforcement and accessories.
 - 4. Waterstops.
 - 5. Curing compounds.
 - 6. Floor and slab treatments.
 - 7. Repair materials.

- D. Material Test Reports: For the following, from a qualified testing agency:

- 1. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

- E. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

- F. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

- 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

- C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

- 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M.

1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
- B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

1.9 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:
 1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301.
2. ACI 117.

2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

2.3 STEEL REINFORCEMENT

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- C. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire into flat sheets.

2.4 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete.

2.5 CONCRETE MATERIALS

- A. Regional Materials: Concrete shall be manufactured within 100 miles of Project site from aggregates and cementitious materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site.
- B. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- C. Cementitious Materials:
 1. Portland Cement: ASTM C 150/C 150M, Type I, gray.
 2. Fly Ash: ASTM C 618, Class F or C.
 3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.
- D. Normal-Weight Aggregates: ASTM C 33/C 33M, coarse aggregate or better, graded. Provide aggregates from a single source.
 1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- E. Water: ASTM C 94/C 94M and potable.

2.6 VAPOR RETARDERS

- A. Sheet Vapor Retarder: ASTM E 1745, Class C. Include manufacturer's recommended adhesive or pressure-sensitive joint tape.
- B. Sheet Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 10 mils thick.

2.7 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

2.8 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.

2.9 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - 1. Fly Ash: 25 percent.
 - 2. Combined Fly Ash and Pozzolan: 25 percent.
 - 3. Slag Cement: 50 percent.
 - 4. Combined Fly Ash or Pozzolan and Slag Cement: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.

2.10 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.11 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, and furnish batch ticket information.
 - 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Chamfer exterior corners and edges of permanently exposed concrete.

3.2 EMBEDDED ITEM INSTALLATION

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.

3.3 VAPOR-RETARDER INSTALLATION

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Lap joints 6 inches and seal with manufacturer's recommended tape.

3.4 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

3.5 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
 - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of **1/8 inch**. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 - 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut **1/8-inch** wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

3.6 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of **ACI 301**.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 - 1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 2. Consolidate placed concrete with mechanical vibrating equipment according to **ACI 301**.

3.7 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces to be covered with a coating or covering material applied directly to concrete.
- C. Rubbed Finish: Apply the following to smooth-formed-finished as-cast concrete where indicated:
1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.8 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of **1/4 inch** in one direction.
1. Apply scratch finish to surfaces indicated and to receive concrete floor toppings to receive mortar setting beds for bonded cementitious floor finishes.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
1. Apply float finish to surfaces indicated to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
1. Apply a trowel finish to surfaces indicated or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
 2. Finish surfaces to the following tolerances, according to **ASTM E 1155**, for a randomly trafficked floor surface:
 - a. Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated where ceramic or quarry tile is to be installed by either thickset or thinset method. While concrete is still plastic, slightly scarify surface with a fine broom.
1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
- G. Slope floor uniform to drains where required.

3.9 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and **ACI 305.1** for hot-weather protection during curing.
- B. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with **12-inch** lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least **12 inches**, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.

3.10 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

3.11 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- B. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231/C 231M, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - a. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
7. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
8. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
10. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

END OF SECTION 033000

SECTION 042113 - BRICK VENEER MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Face brick.
2. Mortar and grout.
3. Ties and anchors.
4. Embedded flashing.
5. Miscellaneous masonry accessories.

B. Related Sections:

1. Section 047200 "Architectural Stone Veneer" for furnishing cast stone trim.
2. Section 055000 "Metal Fabrications" for furnishing steel lintels and shelf angles for brick masonry.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Sustainable Design Submittals:

1. Product Certificates: For materials manufactured within 100 miles of Project, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each raw material.

C. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.

D. Samples for Verification: For each type and color of the following:

1. Face brick.
2. Pigmented mortar. Make Samples using same sand and mortar ingredients to be used on Project.

E. 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.
- F. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.3 QUALITY ASSURANCE

- A. 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.
- B. 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.
- C. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.
- D. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 014000 "Quality Requirements" for mockups.
1. Build sample panels for each type of exposed unit masonry construction in sizes approximately 60 inches long by 48 inches high by full thickness.
 2. Protect approved sample panels from the elements with weather-resistant membrane.
 3. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
 - a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless such deviations are specifically approved by Architect in writing.

1.4 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.

1.5 PROJECT 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 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 deg F 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 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.

2.2 BRICK

- A. Regional Materials: Brick shall be manufactured within 100 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site.
- B. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units.

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 where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
 3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
 4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
- C. Face Brick: Facing brick complying with ASTM C 216.
1. Basis of Design: Acme Brick; Slate Gray.
 2. Grade: SW.
 3. Type: FBX.
 4. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested per ASTM C 67.
 5. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
 6. Size (Actual Dimensions): 3-5/8 inches wide by 3-5/8 inches high by 11-5/8 inches long.

2.3 MORTAR MATERIALS

- A. Regional Materials: Aggregate for mortar, cement, and lime shall be extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- B. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- C. Hydrated Lime: ASTM C 207, Type S.
- D. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- E. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. Use only pigments with a record of satisfactory performance in masonry mortar.
1. Products: Provide one of the following:
 - a. Davis Colors; True Tone Mortar Colors.
 - b. Lanxess Corporation; Bayferrox Iron Oxide Pigments.
 - c. Solomon Colors, Inc; SGS Mortar Colors.
- F. Colored Cement Product: Packaged blend made from portland cement and hydrated lime and mortar pigments, all complying with specified requirements, and containing no other ingredients.
1. Colored Portland Cement-Lime Mix:
 - a. Products: Provide one of the following:

- 1) Capital Materials Corporation; Riverton Portland Cement Lime Custom Color.
 - 2) Holcim (US) Inc; Rainbow Mortamix Custom Color Cement/Lime.
 - 3) Lafarge North America Inc; Eaglebond Portland Cement/Lime.
 - 4) Lehigh Cement Company; Lehigh Custom Color Portland/Lime Cement.
 2. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
 3. Pigments shall not exceed 10 percent of portland cement by weight.
- G. Aggregate for Mortar: ASTM C 144.
1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 2. White-Mortar Aggregates: Natural white sand or crushed white stone.

2.4 REINFORCEMENT

- A. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.

2.5 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.
 2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
- B. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches parallel to face of veneer.
- C. Adjustable Masonry-Veneer Anchors:
1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, 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.
 2. Slip-in, Masonry-Veneer Anchors: Units consisting of a wire tie section and an anchor section designed to interlock with metal studs and be slipped into place as sheathing is installed.
 - a. Basis of Design: Hohmann & Barnard, Inc.; HB-213-2X Adjustable Veneer Anchor.
 - b. Wire-Type Anchor: Bent wire anchor section with an eye to receive the wire tie. Wire tie has a vertical leg that slips into the eye of anchor section and allows

vertical adjustment. Both sections are made from 3/16-inch, hot-dip galvanized wire.

3. Polymer-Coated, Steel Drill Screws for Steel Studs: ASTM C 954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 diameter by length required to penetrate steel stud flange with not less than three exposed threads, and with organic polymer coating with salt-spray resistance to red rust of more than 800 hours per ASTM B 117.
 - a. Products: Provide one of the following:
 - 1) ITW Buildex; Illinois Tool Works, Inc; Teks Maxiseal with Climaseal finish.
 - 2) Leland Industries Inc; Master Drillers with DT2000 Longlife Coating and Master Seal Bonded Washer.
 - 3) Textron Inc; Elco Drill-Flex with Stalgard finish.

2.6 EMBEDDED FLASHING MATERIALS

1. Asphalt-Coated Copper Flashing: 5-oz./sq. ft. copper sheet coated with flexible asphalt. Use only where flashing is fully concealed in masonry. Flashing assembly to include stainless steel termination bar, stainless steel drip edge, and preformed corner sections. For use in conjunction with specified cavity drainage material.
 - a. Basis of Design: Mortar Net USA, Ltd.; TotalFlash.

2.7 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.
- B. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- C. Weep/Vent Products: Use the following unless otherwise indicated:
 1. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch less than depth of outer wythe; in color selected from manufacturer's standard.
 - a. Basis of Design: Mortar Net USA, Ltd; Mortar Net Weep Vents.
- D. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
 1. Basis of Design: Mortar Net USA, Ltd.; Mortar Net.
 2. Configuration: Strips, full-depth of cavity and 10 inches high, with dovetail shaped notches 7 inches deep that prevent clogging with mortar droppings.

2.8 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. Use portland cement-lime mortar unless otherwise indicated.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended 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 C 270, Proportion Specification. Provide Type N unless another type is indicated.
- D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.
 - 1. Pigments shall not exceed 10 percent of portland cement by weight.

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, 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.

3.3 TOLERANCES

- A. General: Comply with Brick Industry Association (BIA) Technical Notes on Brick Construction for the following:
 - 1. Dimensions and location of elements.
 - 2. Line and levels.
 - 3. Joints.

3.4 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: Lay exposed masonry in bond pattern 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.
- E. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow brick as follows:
 - 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 - 2. With entire units, including areas under cells, fully bedded in mortar at starting course on footings.
- B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.6 ANCHORING MASONRY VENEERS

- A. Anchor masonry veneers to wall framing with masonry-veneer anchors to comply with the following requirements:
 - 1. Fasten screw-attached anchors through sheathing to wall framing with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.

2. Insert slip-in anchors in metal studs as sheathing is installed. Provide one anchor at each stud in each horizontal joint between sheathing boards.
3. Embed tie sections in masonry joints. Provide not less than 2 inches of air space between back of masonry veneer and face of sheathing.
4. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
5. Space anchors as indicated, but not more than 18 inches o.c. vertically and 24 inches o.c. horizontally, with not less than 1 anchor for each 2 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 8 inches, around perimeter.

3.7 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 in brick as follows:
 1. Build in compressible joint fillers where indicated.
 2. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Section 079200 "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 Section 079200 "Joint Sealants," but not less than 3/8 inch.
 1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.8 LINTELS

- A. Install steel lintels where indicated.
- B. Provide minimum bearing of 8 inches) at each jamb unless otherwise indicated.

3.9 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.
- B. Install flashing as follows unless otherwise indicated:
 1. 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.
 2. At masonry-veneer walls, install specified flashing system according to manufacturer's written instructions.
 3. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.

4. Terminate flashing at face of wall as indicated on Drawings.
- C. 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 24 inches o.c. unless otherwise indicated.
- D. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

3.10 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. Clean brick by bucket-and-brush hand-cleaning method described in "BIA Technical Notes 20."

3.11 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

END OF SECTION 042113

SECTION 042200 - CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Mortar and grout.
3. Steel reinforcing bars.
4. Masonry-joint reinforcement.

B. Products Installed but not Furnished under This Section:

1. Cast-stone trim in concrete unit masonry.

C. Related Requirements:

1. Section 042113 "Brick Veneer Masonry."

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Certificates: For materials manufactured within 100 miles of Project, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each raw material.

C. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.

1.3 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type and size of the following:

1. Masonry units.
2. Cementitious materials. Include name of manufacturer, brand name, and type.
3. Reinforcing bars.
4. Joint reinforcement.
5. Anchors, ties, and metal accessories.

B. Mix Designs: For each type of mortar. 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 C1506 for water retention, and ASTM C91/C91M for air content.

- C. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.4 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. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.5 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 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.
- 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 TMS 602/ACI 530.1/ASCE 6.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F 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 TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6 except as modified by requirements in the Contract Documents.

- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.

2.2 CONCRETE MASONRY UNITS

- A. Regional Materials: CMUs shall be manufactured within 100 miles of Project site from aggregates that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site.
- B. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
 - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 - 2. Provide square-edged units for outside corners unless otherwise indicated.
- C. CMUs: ASTM C90.
 - 1. Density Classification: Normal weight.
 - 2. Size (Width): Manufactured to dimensions 3/8 inch less-than-nominal dimensions.

2.3 MASONRY LINTELS

- A. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.4 MORTAR MATERIALS

- A. Regional Materials: Aggregate for mortar and grout, cement, and lime shall be manufactured within 100 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site.
- B. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
 - 1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C114.
- C. Hydrated Lime: ASTM C207, Type S.
- D. Aggregate for Mortar: ASTM C144.
 - 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 - 2. White-Mortar Aggregates: Natural white sand or crushed white stone.
- E. Water: Potable.

2.5 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60.
- B. Masonry-Joint Reinforcement, General: Ladder type complying with ASTM A951/A951M.
 - 1. Exterior Walls: 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. Spacing of Cross Rods: Not more than 16 inches o.c.
 - 5. Provide in lengths of not less than 10 feet.

2.6 TIES AND ANCHORS

- A. General: Ties and anchors shall extend at least 1-1/2 inches into masonry but with at least a 5/8-inch cover on outside face.
- B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
 - 1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A82/A82M, with ASTM A153/A153M, Class B-2 coating.
 - 2. Galvanized-Steel Sheet: ASTM A653/A653M, Commercial Steel, G60 zinc coating.
 - 3. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating.

2.7 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 or grout.
 - 2. Use portland cement-lime mortar.
- B. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Provide Type S mortar unless another type is indicated.

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.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
 - 2. Verify that foundations are within tolerances specified.
 - 3. Verify that reinforcing dowels are properly placed.
 - 4. Verify that substrates are free of substances that would impair mortar bond.

- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Build chases and recesses to accommodate items specified in this and other Sections.
- B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.
- C. 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.

3.3 TOLERANCES

- A. General: Comply with NCMA TEK Notes for dimensions and locations of elements, lines and levels, and joints.

3.4 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 and Concealed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; 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 stepping 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.

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow CMUs as follows:
 - 1. Bed face shells in mortar and make head joints of depth equal to bed joints.
 - 2. Fully bed entire units, including areas under cells, at starting course on footings.
- B. Lay solid CMUs with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Set cast-stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.

1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
 2. Wet joint surfaces thoroughly before applying mortar.
 3. Rake out mortar joints for pointing with sealant.
- D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- E. Cut joints flush for concealed masonry.

3.6 MASONRY-JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
1. Space reinforcement not more than 16 inches o.c.
 2. Space reinforcement not more than 8 inches o.c. in foundation walls.
- B. Cut and bend reinforcing units as directed by manufacturer for continuity at corners.
1. Install temporary foam-plastic filler in head joints, and remove filler when unit masonry is complete for application of sealant.

3.7 LINTELS

- A. Provide masonry lintels where shown.

3.8 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. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.9 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

- B. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042200

SECTION 047200 - ARCHITECTURAL STONE VENEER

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes architectural stone veneer.
- B. Related Requirements:
 - 1. Section 042113 "Brick Veneer Masonry" for veneer anchorage to sheathed substrates, flashing, and weep provisions.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Sustainable Design Submittals:
 - 1. Product Certificates: For materials manufactured within **100 miles** of Project, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each raw material.
- C. Shop Drawings: Show fabrication and installation details. Include dimensions, details of reinforcement and anchorages, and indication of finished faces.
 - 1. Include building elevations showing layout of units and locations of joints and anchors.
- D. Samples for Verification:
 - 1. For each color and texture of architectural stone veneer required, 10 inches square in size.
 - 2. For colored mortar. Make Samples using same sand and mortar ingredients to be used on Project. Label Samples to indicated types and amounts of pigments used.

1.3 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build mockup of typical wall area as shown on Drawings.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Coordinate delivery of architectural stone veneer with brick masonry work to avoid delaying the Work.

- B. Pack, handle, and ship architectural stone veneer units in suitable packs or pallets.
 - 1. Store architectural stone veneer units on wood skids or pallets with nonstaining, waterproof covers, securely tied. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.
- C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- D. Store mortar aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

1.5 PROJECT CONDITIONS

- A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Comply with cold-weather construction requirements in ACI 530.1/ASCE 6/TMS 602.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until architectural stone veneer has dried, but no fewer than seven days after completing cleaning.
- B. Hot-Weather Requirements: Comply with hot-weather construction requirements in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL STONE VENEER MATERIALS

- A. General: Comply with ASTM C 1364.
- B. Portland Cement: ASTM C 150, Type I or Type III, containing not more than 0.60 percent total alkali when tested according to ASTM C 114. Provide natural color or white cement as required to produce architectural stone veneer color indicated.
- C. Coarse Aggregates: Granite, quartz, or limestone complying with ASTM C 33; gradation and colors as needed to produce required architectural stone veneer textures and colors.
- D. Fine Aggregates: Natural sand or crushed stone complying with ASTM C 33, gradation and colors as needed to produce required architectural stone veneer textures and colors.
- E. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.
- F. Admixtures: Use only admixtures specified or approved in writing by Architect.
 - 1. Do not use admixtures that contain more than 0.1 percent water-soluble chloride ions by mass of cementitious materials. Do not use admixtures containing calcium chloride.
 - 2. Use only admixtures that are certified by manufacturer to be compatible with cement and other admixtures used.
 - 3. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 4. Water-Reducing, Retarding Admixture: ASTM C 494/C 494M, Type D.

- 5. Water-Reducing, Accelerating Admixture: ASTM C 494/C 494M, Type E.
- G. Water: Potable.
- H. Reinforcement and Veneer Anchorage: Specified in Section 042113 "Brick Masonry."

2.2 ARCHITECTURAL STONE VENEER

- A. Basis of Design: Reading Rock, Inc.; RockCast Architectural Masonry Veneer Series.
- B. Regional Materials: Cast stone units shall be manufactured within 100 miles of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site.
- C. Casting Method: Machine.
 - 1. Provide units that are resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666/C 666M, Procedure A, as modified by ASTM C 1364.
- D. Fabricate units with sharp arris and accurately reproduced details, with indicated texture on all exposed surfaces unless otherwise indicated.
 - 1. Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated.
 - 2. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
 - 3. Provide drips on projecting elements unless otherwise indicated.
- E. Fabrication Tolerances:
 - 1. Variation in Cross Section: Do not vary from indicated dimensions by more than 1/8 inch.
 - 2. Variation in Length: Do not vary from indicated dimensions by more than 1/360 of the length of unit or 1/8 inch, whichever is greater, but in no case by more than 1/4 inch.
 - 3. Warp, Bow, and Twist: Not to exceed 1/360 of the length of unit or 1/8 inch, whichever is greater.
 - 4. Location of Grooves, False Joints, Holes, Anchorages, and Similar Features: Do not vary from indicated position by more than 1/8 inch on formed surfaces of units and 3/8 inch on unformed surfaces.
- F. Curing: Cure in enclosed chamber at 95 percent relative humidity and 95 to 120 deg F for 12 to 18 hours and yard cure for 350 degree-days.
- G. Colors and Textures: As scheduled on Drawings.

2.3 MORTAR MATERIALS

- A. Provide mortar materials that comply with Section 042113 "Brick Veneer Masonry."

2.4 ACCESSORIES

- 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 architectural stone veneer manufacturer and expressly approved by cleaner manufacturer for use on architectural stone veneer and adjacent masonry materials.
 - 1. Manufacturers: Provide products by one of the following:
 - a. Diedrich Technologies, Inc.
 - b. EaCo Chem, Inc.
 - c. ProSoCo, Inc.

2.5 MORTAR MIXES

- A. Comply with requirements in Section 042113 "Brick Veneer Masonry" for mortar mixes.
- B. Comply with ASTM C 270, Proportion Specification.
 - 1. For setting mortar, use Type N.
 - 2. For pointing mortar, use Type N.

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 work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SETTING ARCHITECTURAL STONE VENEER IN MORTAR

- A. Install architectural stone veneer units to comply with requirements in Section 042113 "Brick Masonry."
- B. Set architectural stone veneer as indicated on Drawings. Set units accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.
 - 1. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place.
 - 2. Coordinate installation of architectural stone veneer with installation of flashing specified in other Sections.
- C. Wet joint surfaces thoroughly before applying mortar or setting in mortar.

- D. Set units in full bed of mortar with full head joints unless otherwise indicated.
 - 1. Set units with joints 3/8 to 1/2 inch wide, unless otherwise indicated.
 - 2. Build anchors and ties into mortar joints as units are set.
 - 3. Build concealed flashing into mortar joints as units are set.
 - 4. Keep head joints in units with exposed horizontal surfaces open to receive sealant.
 - 5. Keep joints at shelf angles open to receive sealant.
- E. Rake out joints for pointing with mortar to depths of not less than 3/4 inch. Rake joints to uniform depths with square bottoms and clean sides. Scrub faces of units to remove excess mortar as joints are raked.
- F. Point mortar joints by placing and compacting mortar in layers not greater than 3/8 inch. Compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.
- G. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- H. Provide sealant joints at horizontal surfaces, at expansion, control, and pressure-relieving joints, and at locations indicated.
 - 1. Keep joints free of mortar and other rigid materials.
 - 2. Build in compressible foam-plastic joint fillers where indicated.
 - 3. Form joint of width indicated, but not less than 3/8 inch.
 - 4. Prime architectural stone veneer surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.
 - 5. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 079200 "Joint Sealants."

3.3 INSTALLATION TOLERANCES

- A. Variation from Plumb: Do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
- B. Variation from Level: Do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
- C. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch in 36 inches or one-fourth of nominal joint width, whichever is less.
- D. Variation in Plane between Adjacent Surfaces (Lipping): Do not vary from flush alignment with adjacent units or adjacent surfaces indicated to be flush with units by more than 1/16 inch, except where variation is due to warpage of units within tolerances specified.

3.4 ADJUSTING AND CLEANING

- A. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Architectural stone veneer may be repaired if methods and results are approved by Architect.
- B. Replace units in a manner that results in architectural stone veneer matching approved Samples, complying with other requirements, and showing no evidence of replacement.

- C. In-Progress Cleaning: Clean architectural stone veneer as work progresses.
1. Remove mortar fins and smears before tooling joints.
 2. Remove excess sealant immediately, including spills, smears, and spatter.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed architectural stone veneer as follows:
1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 2. Test cleaning methods on sample; leave one sample uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of architectural stone veneer.
 3. Protect adjacent surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 4. Wet surfaces with water before applying cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
 5. Clean architectural stone veneer with proprietary acidic cleaner applied according to manufacturer's written instructions.

END OF SECTION 047200

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Structural steel.
 - 2. Grout.
- B. Related Sections:
 - 1. Section 053100 "Steel Decking" for field installation of shear connectors through deck.
 - 2. Section 055000 "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame miscellaneous steel fabrications and other metal items not defined as structural steel.

1.3 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- B. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SLRS" or along grid lines designated as "SLRS" on Drawings, including columns, beams, and braces and their connections.

1.4 PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator, including comprehensive engineering analysis by a qualified professional engineer, to withstand loads indicated and comply with other information and restrictions indicated.
 - 1. Use LRFD; data are given at factored-load level.
- B. Moment Connections: Type FR, fully restrained.
- C. Construction: Moment frames at Drive-Thru and Braced Frames at Building.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

B. Sustainable Design Submittals

1. **Product Data:** For recycled content, indicating postconsumer and pre-consumer recycled content and cost.

C. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
5. For structural-steel connections indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Delegated-Design Submittal: For structural-steel connections indicated to comply with design loads, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer, fabricator, and testing agency.
- B. Welding certificates.
- C. Mill test reports for structural steel, including chemical and physical properties.
- D. Source quality-control reports.

1.7 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator who is experienced in this type of steel fabrication.
- B. Installer Qualifications: A qualified installer who is experienced in steel erection of this type.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- D. Comply with applicable provisions of the following specifications and documents:
 1. AISC 303.
 2. AISC 341 and AISC 341s1.
 3. AISC 360.
 4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
 - 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
 - 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 - 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
 - 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

1.9 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

- A. **Recycled Content of Steel Products:** Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.
- B. W-Shapes: ASTM A 992, Grade 50.
- C. Channels and Angles: ASTM A 36.
- D. Plate and Bar: ASTM A 36.
- E. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B or Grade C, structural tubing.
- F. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers; all with plain finish.

B. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.

1. Nuts: ASTM A 563 heavy-hex carbon steel.
2. Plate Washers: ASTM A 36/A 36M carbon steel.
3. Washers: ASTM F 436, Type 1, hardened carbon steel.
4. Finish: Plain.

2.3 PRIMER

A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

2.4 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.

1. Camber structural-steel members where indicated.
2. Fabricate beams with rolling camber up.
3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
4. Mark and match-mark materials for field assembly.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.7 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
 2. Surfaces to be field welded.
 3. Galvanized surfaces.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits.

2.8 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
 1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.
 2. Galvanize lintels attached to structural-steel frame and located in exterior walls.

2.9 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.
 1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- C. Bolted Connections: Shop-bolted connections will be[tested and] inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 1. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 2. Ultrasonic Inspection: ASTM E 164.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
 - 1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of baseplate.
 - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
 - 2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.
- B. Bolted Connections: Bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: Field welds will be visually inspected according to AWS D1.1/D1.1M.
 - 1. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - a. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - b. Ultrasonic Inspection: ASTM E 164.
- D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.

END OF SECTION 051200

SECTION 052100 - STEEL JOIST FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. K-series steel joists.
 - 2. K-series steel joist substitutes.
 - 3. Joist accessories.
- B. Related Requirements:
 - 1. Section 051200 "Structural Steel Framing" for field-welded shear connectors.

1.3 DEFINITIONS

- A. SJI's "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."
- B. Special Joists: Steel joists or joist girders requiring modification by manufacturer to support nonuniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of joist, accessory, and product.
- B. Sustainable Design Submittals:
 - 1. **Product Data:** For recycled content, indicating postconsumer and pre-consumer recycled content and cost.
- C. Shop Drawings:
 - 1. Include layout, designation, number, type, location, and spacing of joists.
 - 2. Include joining and anchorage details, bracing, bridging, and joist accessories; splice and connection locations and details; and attachments to other construction.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.

- B. Welding certificates.
- C. Manufacturer certificates.
- D. Mill Certificates: For each type of bolt.
- E. Comprehensive engineering analysis of special joists signed and sealed by the qualified professional engineer responsible for its preparation.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables in SJI's "Specifications."
 - 1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.
- B. Welding Qualifications: Qualify field-welding procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle joists as recommended in SJI's "Specifications."
- B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated.
 - 1. Use ASD; data are given at service-load level.
 - 2. Design special joists to withstand design loads with live-load deflections no greater than the following:
 - a. Roof Joists: Vertical deflection of 1/240 of the span.
- B. **Recycled Content of Steel Products:** Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.

2.2 K-SERIES STEEL JOISTS

- A. Manufacture steel joists of type indicated according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.
 - 1. Joist Type: K-series steel joists.

- B. Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.
- C. Provide holes in chord members for connecting and securing other construction to joists.
- D. Top-Chord Extensions: Extend top chords of joists with SJI's Type S top-chord extensions where indicated, complying with SJI's "Specifications."
- E. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated, complying with SJI's "Specifications."
- F. Camber joists according to SJI's "Specifications."
- G. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.3 PRIMERS

- A. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.

2.4 JOIST ACCESSORIES

- A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.
- B. Furnish ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch of finished wall surface unless otherwise indicated.
- C. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

2.5 CLEANING AND SHOP PAINTING

- A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2, or power-tool cleaning, SSPC-SP 3.
- B. Apply one coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Do not install joists until supporting construction is in place and secured.
- B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJl's "Specifications," joist manufacturer's written recommendations, and requirements in this Section.
 - 1. Before installation, splice joists delivered to Project site in more than one piece.
 - 2. Space, adjust, and align joists accurately in location before permanently fastening.
 - 3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
- C. Field weld joists to supporting steel framework. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
- D. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and bolted connections and to perform field tests and inspections and prepare test and inspection reports.
- B. Visually inspect field welds according to AWS D1.1/D1.1M.
 - 1. In addition to visual inspection, test field welds according to AWS D1.1/D1.1M and the following procedures, as applicable:
 - a. Magnetic Particle Inspection: ASTM E 709.
- C. Visually inspect bolted connections.
- D. Correct deficiencies in Work that test and inspection reports have indicated are not in compliance with specified requirements.
- E. Perform additional testing to determine compliance of corrected Work with specified requirements.

3.4 PROTECTION

- A. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists abutting structural steel, and accessories.
 - 1. Clean and prepare surfaces by hand-tool cleaning according to SSPC-SP 2, or power-tool cleaning according to SSPC-SP 3.

2. Apply a compatible primer of same type as primer used on adjacent surfaces.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that joists and accessories are without damage or deterioration at time of Substantial Completion.

END OF SECTION 052100

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Roof deck.

- B. Related Requirements:

- 1. Section 051200 "Structural Steel Framing" for shop- and field-welded shear connectors.
 - 2. Section 055000 "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.
 - 3. Section 099113 "Exterior Painting" for repair painting of primed deck and finish painting of deck.
 - 4. Section 099123 "Interior Painting" for repair painting of primed deck and finish painting of deck.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.

- B. Sustainable Design Submittals:

- 1. **Product Data:** For recycled content, indicating postconsumer and preconsumer recycled content and cost.

- C. Shop Drawings:

- 1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

- B. Product Certificates: For each type of steel deck.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
- B. **Recycled Content of Steel Products:** Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

2.2 ROOF DECK

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ASC Profiles, Inc.; a Blue Scope Steel company.
 - 2. Canam United States; Canam Group Inc.
 - 3. CMC Joist & Deck.
 - 4. Consolidated Systems, Inc.; Metal Dek Group.
 - 5. Cordeck.
 - 6. DACS, Inc.
 - 7. Epic Metals Corporation.
 - 8. Marlyn Steel Decks, Inc.
 - 9. New Millennium Building Systems, LLC.
 - 10. Nucor Corp.; Vulcraft Group.
 - 11. Roof Deck, Inc.
 - 12. Valley Joist; Subsidiary of EBSCO Industries, Inc.
 - 13. Verco Manufacturing Co.
 - 14. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.
- B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
 - 1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33zinc coating.
 - a. Color: Manufacturer's standard.

2. Profile Depth: As indicated.
3. Design Uncoated-Steel Thickness: As indicated.
4. Design Uncoated-Steel Thicknesses; Deck Unit/Bottom Plate: As indicated.
5. Span Condition: Triple span or more.
6. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.3 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- F. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.
- G. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with 3-inch-wide flanges and level or sloped recessed pans of 1-1/2-inch minimum depth. For drains, cut holes in the field.
- H. Galvanizing Repair Paint: ASTM A 780.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.

- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF-DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:
 - 1. Weld Diameter: 5/8 inch, nominal.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals as indicated:
 - 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
 - 2. Fasten with a minimum of 1-1/2-inch-long welds.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
 - 1. End Joints: Lapped 2 inches minimum.
- D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld flanges to top of deck. Space welds not more than 12 inches apart with at least one weld at each corner.
 - 1. Install reinforcing channels or zees in ribs to span between supports and weld.
- E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.
 - 1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.
- F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Field welds will be subject to inspection.
- C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.
- D. Remove and replace work that does not comply with specified requirements.
- E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.5 PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 053100

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel framing and supports for overhead coiling grilles.
2. Steel framing and supports for mechanical and electrical equipment.
3. Steel framing and supports for applications where framing and supports are not specified in other Sections.
4. Shelf angles.
5. Metal ladders.
6. Metal bollards.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.

C. Related Requirements:

1. Section 042113 "Brick Veneer Masonry" and Section 047200 "Architectural Stone Veneer" for installing loose lintels, anchor bolts, and other items built into unit masonry.
2. Section 051200 "Structural Steel Framing."

1.2 COORDINATION

A. 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.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. 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.

1.3 SUBMITTALS

A. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

C. Delegated-Design Submittal: For ladders, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

- D. Qualification Data: For professional engineer.
- E. Welding certificates.

1.4 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.5 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer to design ladders.

2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- C. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- D. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.
- E. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

- C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
 - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- D. 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 E 488/E 488M, conducted by a qualified independent testing agency.
- E. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.4 MISCELLANEOUS MATERIALS

- A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- B. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- F. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi.

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

- D. Form exposed work with accurate angles and surfaces and straight edges.
- 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.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
- C. Galvanize miscellaneous framing and supports where indicated.

2.7 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to supporting substrate.
 - 1. Provide mitered and welded units at corners.
 - 2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.
- B. Galvanize shelf angles located in exterior walls.

2.8 METAL LADDERS

- A. General: Comply with ANSI A14.3.

B. Steel Ladders:

1. Space siderails 16 inches apart unless otherwise indicated.
2. Siderails: Continuous, 3/8-by-2-1/2-inch steel flat bars, with eased edges.
3. Rungs: 3/4-inch diameter steel bars.
4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
5. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
6. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets.
7. Galvanize ladders, including brackets.

2.9 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 40 steel pipe.

1. Cap bollards with 1/4-inch thick steel plate.

2.10 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span, but not less than 8 inches unless otherwise indicated.
- C. Galvanize loose steel lintels located in exterior walls.

2.11 FINISHES, GENERAL

- A. Finish metal fabrications after assembly.
- B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.12 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
- B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
- C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete or masonry, or unless otherwise indicated.
1. Shop prime with universal shop primer.

- D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
 - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Other Items: SSPC-SP 3, "Power Tool Cleaning."
- E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. 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.
- C. 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 no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 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 overhead grilles securely to, and rigidly brace from, building structure.

3.3 INSTALLING METAL BOLLARDS

- A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.

- B. 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 nonshrink grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward bollard.
- C. Fill bollards solidly with concrete, mounding top surface to shed water.

3.4 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 055000

SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Wood blocking and nailers.
 - 2. Plywood backing panels.
- B. Related Requirements:
 - 1. Section 061600 "Sheathing" for sheathing.

1.2 SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 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. 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.
 - 3. 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.
 - 4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
- B. Sustainable Design Submittals:
 - 1. Product Certificates: For materials manufactured within 100 miles of Project, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each raw material.
 - 2. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
 - 3. Chain-of-Custody Qualification Data: For manufacturer and vendor.
 - 4. Product Data: For installation adhesives, indicating VOC content.
 - 5. Laboratory Test Reports: For installation adhesives, indicating compliance with requirements for low-emitting materials.
- C. Evaluation Reports: For the following, from ICC-ES:
 - 1. Preservative-treated wood.
 - 2. Fire-retardant-treated wood.
 - 3. Power-driven fasteners.
 - 4. Post-installed anchors.

1.3 QUALITY ASSURANCE

- A. 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.
- B. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
- C. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Regional Materials: Dimension lumber shall be manufactured within 100 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site.
- B. Certified Wood: Lumber and plywood shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-001 and FSC STD-40-004.
- C. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. Dress lumber, S4S, unless otherwise indicated.
- D. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWPAC U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat items indicated on Drawings, and the following:
 - 1. Wood nailers, blocking, and similar members in connection with roofing, flashing, and vapor barriers.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
 - 1. Treatment shall not promote corrosion of metal fasteners.
 - 2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
 - 3. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664, and design value adjustment factors shall be calculated according to ASTM D 6841.
- C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
- E. Application: Treat items indicated on Drawings, and the following:
 - 1. Concealed blocking.
 - 2. Plywood backing panels.

2.4 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
- B. Dimension Lumber Items: Construction or No. 2 grade lumber of any species.
- C. 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.

2.5 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.6 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Screws for Fastening to Metal Framing: ASTM C 954, length as recommended by screw manufacturer for material being fastened.
- D. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- E. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC58, ICC-ES AC193, or ICC-ES AC308 as appropriate for the substrate.
 - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

2.7 MISCELLANEOUS MATERIALS

- A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate[furring,] nailers, blocking, [grounds,] and similar supports to comply with requirements for attaching other construction.
- C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.

- D. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
- E. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- F. Comply with AWP M4 for applying field treatment to cut surfaces of preservative-treated lumber.
- G. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- H. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
 - 2. ICC-ES evaluation reports for fasteners.
- I. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 WOOD BLOCKING AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

END OF SECTION 061053

SECTION 061600 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wall sheathing.
2. Parapet sheathing.

B. Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for plywood backing panels.
2. Section 072500 "Weather Barriers" for water-resistive barrier applied over wall sheathing.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5516.
4. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

B. Sustainable Design Submittals:

1. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
2. Chain-of-Custody Qualification Data: For manufacturer and vendor.
3. Laboratory Test Reports: For composite wood products, indicating compliance with requirements for low-emitting materials.
4. Product Data: For installation adhesives, indicating VOC content.
5. Laboratory Test Reports: For installation adhesives, indicating compliance with requirements for low-emitting materials.

C. Qualification Data: For Installer.

D. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated plywood.
2. Fire-retardant-treated plywood.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
- B. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PANEL PRODUCTS

- A. Emissions: Products shall meet 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."
- B. Certified Wood: The following wood products shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-001 and FSC STD-40-004.
 1. Plywood.
- C. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
- D. Factory mark panels to indicate compliance with applicable standard.

2.2 PRESERVATIVE-TREATED PLYWOOD

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.
 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
- C. Application: Treat items indicated on Drawings.

2.3 FIRE-RETARDANT-TREATED PLYWOOD

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
 - 1. Use treatment that does not promote corrosion of metal fasteners.
 - 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
 - 3. Design Value Adjustment Factors: Treated lumber plywood shall be tested according to ASTM D5516 and design value adjustment factors shall be calculated according to ASTM D6305. Span ratings after treatment shall be not less than span ratings specified.
- C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.
- E. Application: Treat plywood indicated on Drawings.

2.4 WALL SHEATHING

- A. Plywood Sheathing: DOC PS 1, Exterior sheathing.
 - 1. Span Rating: Not less than 32/16.
 - 2. Nominal Thickness: As indicated on Drawings.

2.5 PARAPET SHEATHING

- A. Plywood Sheathing: DOC PS 1, Exterior sheathing.
 - 1. Span Rating: Not less than 40/20.
 - 2. Nominal Thickness: As indicated on Drawings.

2.6 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. For parapet and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.
- B. Nails, Brads, and Staples: ASTM F1667.

- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Screws for Fastening Sheathing to Wood Framing: ASTM C1002.
- E. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
 - 2. ICC-ES evaluation report for fasteners.
- D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.
- E. Coordinate wall and parapet sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:

1. Wall and Parapet Sheathing:
 - a. Screw to cold-formed metal framing.
 - b. Space panels 1/8 inch apart at edges and ends.

END OF SECTION 061600

SECTION 064116 - PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic-laminate-faced architectural cabinets.
2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets unless concealed within other construction before cabinet installation.

B. Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets and concealed within other construction before cabinet installation.
2. Section 123623 "Plastic-Laminate-Clad Countertops."

1.2 PREINSTALLATION MEETINGS

- ##### A. Preinstallation Conference: Conduct conference at Project site.

1.3 SUBMITTALS

A. Product Data: For each type of product.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Product Certificates: For materials manufactured within 100 miles of Project, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each raw material.
3. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
4. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
5. Laboratory Test Reports: For composite wood products, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show details full size.

2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
3. Show locations and sizes of cutouts and holes for electrical switches and outlets and other items installed in architectural plastic-laminate cabinets.
4. Apply AWI Quality Certification Program label to Shop Drawings.

D. Samples for Verification:

1. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish, with one sample applied to core material and specified edge material applied to one edge.
2. Exposed cabinet hardware and accessories, one unit for each type and finish.

E. Qualification Data: For fabricator.

F. Product Certificates: For the following:

1. Thermoset decorative panels.
2. High-pressure decorative laminate.

G. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
- B. Installer Qualifications: Fabricator of products.

1.5 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.

1.6 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. 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.
 1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.

1.7 COORDINATION

- A. 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.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

- A. 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 labels from AWI certification program indicating that woodwork complies with requirements of grades specified.
- B. Grade: Premium.
- C. Regional Materials: Wood products shall be manufactured within 100 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site.
- D. Certified Wood: Wood products shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-001 and FSC STD-40-004.
- E. Type of Construction: Frameless.
- F. Cabinet, Door, and Drawer Front Interface Style: Reveal overlay.
- G. Reveal Dimension: 1/2 inch.
- H. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.
 - 1. Manufacturers, Basis of Design: As indicated on Drawings.
- I. Laminate Cladding for Exposed Surfaces:
 - 1. Horizontal Surfaces: Grade HGS.
 - 2. Postformed Surfaces: Grade HGP.
 - 3. Vertical Surfaces: Grade HGS.
 - 4. Edges: Grade HGS.
 - 5. Pattern Direction: As indicated.
- J. Materials for Semiexposed Surfaces:
 - 1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade VGS.
 - a. Edges of Plastic-Laminate Shelves: PVC tape, 0.018-inch minimum thickness, matching laminate in color, pattern, and finish.

- b. Edges of Thermoset Decorative Panel Shelves: PVC or polyester edge banding.
 - c. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade VGS.
- 2. Drawer Sides and Backs: Thermoset decorative panels with PVC or polyester edge banding.
- 3. Drawer Bottoms: Thermoset decorative panels.
- K. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.
- L. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
 - 1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners.
- M. Colors, Patterns, and Finishes: As indicated on Drawings.

2.2 WOOD MATERIALS

- A. 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.
- B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
 - 1. Recycled Content of MDF and Particleboard: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- C. Composite Wood Products: Products shall be made using ultra-low-emitting formaldehyde resins as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.
 - 1. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade 130.
 - 2. Particleboard: ANSI A208.1, Grade M-2.
 - 3. Straw-Based Particleboard: ANSI A208.1, Grade M-2, except for density.
 - a. Products: Provide one of the following:
 - 1) Environ Biocomposites Manufacturing LLC; Biofiber Wheat.
 - 2) Sorm Incorporated; Primeboard Premium Wheat.
 - 4. Softwood Plywood: DOC PS 1.
 - 5. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.
 - 6. Thermoset Decorative Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.3 CABINET HARDWARE AND ACCESSORIES

- A. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 110 degrees of opening, self-closing.
- B. Wire Pulls: Back mounted, solid metal, 4 inches long, 5/16 inch in diameter.
- C. Shelf Rests: BHMA A156.9, B04013; metal.
- D. Drawer Slides: BHMA A156.9.
 - 1. Grade 1: Side mounted; full-extension type; zinc-plated steel with polymer rollers.
- E. Door Locks: BHMA A156.11, E07121.
- F. Drawer Locks: BHMA A156.11, E07041.
- G. Door and Drawer Silencers: BHMA A156.16, L03011.
- H. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
 - 1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.
- I. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.4 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.
- B. 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.
- C. Adhesives: Do not use adhesives that contain urea formaldehyde.
- D. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.
 - 1. Adhesive for Bonding Edges: Hot-melt adhesive.

2.5 FABRICATION

- A. Fabricate cabinets to dimensions, profiles, and details indicated.
- B. 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.

- C. 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.

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.

3.2 INSTALLATION

- A. Grade: Install cabinets to comply with same grade as item to be installed.
- B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.
- C. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
- D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- 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 for exposed fastening, countersunk and filled flush with woodwork.
 - 1. Use filler matching finish of items being installed.
- F. Cabinets: Install 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.
 - 1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 - 2. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch penetration into blocking or hanging strips and No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

- B. Clean, lubricate, and adjust hardware.
- C. Clean cabinets on exposed and semiexposed surfaces.

END OF SECTION 064116

SECTION 066400 - PLASTIC PANELING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Plastic sheet paneling.
 - 2. Factory-laminated plastic sheet paneling.

1.2 SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. Product Data: For adhesives, indicating VOC content.
 - 2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
 - 3. Product Data: For sealants, indicating VOC content.
 - 4. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.
 - 5. Laboratory Test Reports: For wall materials, indicating compliance with requirements for low-emitting materials.
- C. Samples: For plastic paneling and trim accessories, in manufacturer's standard sizes.

1.3 QUALITY ASSURANCE

- A. Testing Agency: Acceptable to authorities having jurisdiction.

1.4 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.

2.2 PLASTIC SHEET PANELING

- A. Glass-Fiber-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D 5319.
 - 1. Basis of Design Manufacturer: Marlite.
 - 2. Wall materials shall comply with the 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."
 - 3. Surface-Burning Characteristics: As follows when tested by a qualified testing agency according to ASTM E 84. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
 - 4. Nominal Thickness: Not less than 0.09 inch.
 - 5. Surface Finish: Molded pebble texture.
 - 6. Color: As scheduled on Drawings.

2.3 ACCESSORIES

- A. Trim Accessories: Manufacturer's standard one-piece vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.
 - 1. Color: Match panels.
- B. Exposed Fasteners: Nylon drive rivets recommended by panel manufacturer.
- C. Concealed Mounting Splines: Continuous, H-shaped aluminum extrusions designed to fit into grooves routed in edges of factory-laminated panels and to be fastened to substrate.
- D. Adhesive: As recommended by plastic paneling manufacturer.
 - 1. Adhesives shall have a VOC content of 50 g/L or less.
 - 2. Adhesive 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."
- E. Sealant: Mildew-resistant, single-component, neutral-curing or acid-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 079200 "Joint Sealants."
 - 1. Sealant shall have a VOC content of 250 g/L or less.
 - 2. Sealant 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."

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 PREPARATION

- A. Remove loose or soluble paint, and other materials that might interfere with adhesive bond.
- B. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.
- C. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.
- D. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.
- E. Lay out paneling before installing. Locate panel joints where indicated.
 - 1. Mark plumb lines on substrate at trim accessory locations for accurate installation.
 - 2. Locate trim accessories to allow clearance at panel edges according to manufacturer's written instructions.

3.3 INSTALLATION

- A. Install plastic paneling according to manufacturer's written instructions.
- B. Install panels in a full spread of adhesive.
- C. Install panels with fasteners. Layout fastener locations and mark on face of panels so that fasteners are accurately aligned.
 - 1. Drill oversized fastener holes in panels and center fasteners in holes.
 - 2. Apply sealant to fastener holes before installing fasteners.
- D. Install factory-laminated panels using concealed mounting splines in panel joints.
- E. Install trim accessories with [adhesive] [and] [nails] [or] [staples]. [Do not fasten through panels.]
- F. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.
- G. Maintain uniform space between panels and wall fixtures. Fill space with sealant.
- H. Maintain uniform space between adjacent panels and between panels and floors, ceilings, and fixtures. Fill space with sealant.

- I. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION 066400

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Foam-plastic board insulation.
2. Glass-fiber blanket insulation.

B. Related Requirements:

1. Section 075423 "Thermoplastic Polyolefin (TPO) Roofing" for insulation specified as part of roofing construction.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Product Data: For adhesives, indicating VOC content.
3. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
4. Laboratory Test Reports: For insulation, indicating compliance with requirements for low-emitting materials.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

1.3 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.4 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. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.

2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 FOAM-PLASTIC BOARD INSULATION

- A. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and minimum compressive strength indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
 1. Manufacturers: Provide products by one of the following:
 - a. DiversiFoam Products.
 - b. Dow Chemical Company (The).
 - c. Owens Corning.
 - d. Pactiv Building Products.
 2. Type IV, 25 psi.
- B. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

2.2 GLASS-FIBER BLANKET INSULATION

- A. Manufacturers: Provide products by one of the following:
 1. CertainTeed Corporation.
 2. Guardian Building Products, Inc.
 3. Johns Manville.
 4. Knauf Insulation.
 5. Owens Corning.
- B. Insulation shall comply with the 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."
- C. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- D. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
- E. Reinforced-Foil-Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type III (reflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.

2.3 ACCESSORIES

- A. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.
 - 1. Adhesives shall have a VOC content of 70 g/L or less.
 - 2. Adhesive 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."

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation 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 ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area 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 BELOW-GRADE INSULATION

- A. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
 - 1. If not otherwise indicated, extend insulation a minimum of 24 inches in from exterior walls.

3.4 INSTALLATION OF CAVITY-WALL INSULATION

- A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches 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.

3.5 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Glass-Fiber Blanket Insulation: Install in cavities formed by framing members 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.
 - 3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 - 4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
 - 5. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.
 - a. Exterior Walls: Set units with facing placed as indicated on Drawings.

3.6 INSTALLATION OF INSULATION IN CEILINGS FOR SOUND ATTENUATION

- A. Where glass-fiber blankets are indicated for sound attenuation above ceilings, install blanket insulation over entire ceiling area in thicknesses indicated. Extend insulation 48 inches up either side of partitions.

3.7 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 072100

SECTION 072413 - POLYMER-BASED EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. EIFS-clad barrier-wall assemblies that are field applied over substrate.

1.2 DEFINITIONS

- A. Definitions in ASTM E 2110 apply to Work of this Section.
- B. EIFS: Exterior insulation and finish system(s).
- C. IBC: International Building Code.
- D. Polymer-Based Exterior Insulation and Finish System: Class PB EIFS, as defined in ASTM E 2568.

1.3 SUBMITTALS

- A. Product Data: For each EIFS component, trim, and accessory.
- B. Sustainable Design Submittals:
1. Product Data: For adhesives, indicating VOC content.
 2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
 3. Product Data: For coatings, indicating VOC content.
 4. Laboratory Test Reports: For coatings, indicating compliance with requirements for low-emitting materials.
- C. Samples for Verification: 24-inch square panels for each type of finish-coat color and texture indicated, prepared using same tools and techniques intended for actual work.
- D. Qualification Data: For Installer.
- E. Manufacturer Certificates: Signed by EIFS manufacturer, certifying the following:
1. EIFS substrate is acceptable to EIFS manufacturer.
 2. Accessory products installed with EIFS, including joint sealants, flashing, and trim, whether or not furnished by EIFS manufacturer and whether or not specified in this Section, are acceptable to EIFS manufacturer.
- F. Product Certificates: For insulation, from manufacturer.

- G. Product Test Reports: For each EIFS assembly and component, for tests performed by a qualified testing agency.
- H. Sample Warranty: For manufacturer's special warranty.
- I. Maintenance Data: For EIFS to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An installer who is certified in writing by AWCI International as qualified to install Class PB EIFS using trained workers.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original, unopened packages with manufacturers' labels intact and clearly identifying products.
- B. Store materials inside and under cover; keep them dry and protected from weather, direct sunlight, surface contamination, aging, corrosion, damaging temperatures, construction traffic, and other causes.
 - 1. Stack insulation board flat and off the ground.
 - 2. Protect plastic insulation against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
 - 3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.6 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions and ambient outdoor air, humidity, and substrate temperatures permit EIFS to be applied, dried, and cured according to manufacturers' written instructions and warranty requirements.
 - 1. Proceed with installation of adhesives or coatings only when ambient temperatures have remained, or are forecast to remain, above 40 deg F for a minimum of 24 hours before, during, and after application. Do not apply EIFS adhesives or coatings during rainfall.

1.7 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of EIFS that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Bond integrity and weathertightness.
 - b. Deterioration of EIFS finishes and other EIFS materials beyond normal weathering.
 - 2. Warranty coverage includes the following EIFS components:

- a. EIFS finish, including base coats, finish coats, and reinforcing mesh.
 - b. Insulation installed as part of EIFS.
 - c. Insulation adhesive.
 - d. EIFS accessories, including trim components and flashing.
3. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design Manufacturer: Dryvit Systems, Inc.
 1. Dryvit Systems, Inc.
- B. Source Limitations: Obtain EIFS from single source from single EIFS manufacturer and from sources approved by EIFS manufacturer as tested and compatible with EIFS components.

2.2 PERFORMANCE REQUIREMENTS

- A. EIFS Performance: Comply with ASTM E 2568 and with the following:
 1. Weathertightness: Resistant to water penetration from exterior.
 2. Structural Performance of Assembly and Components:
 - a. Wind Loads: Uniform pressure as indicated on Drawings.
 3. Impact Performance: ASTM E 2568, Standard impact resistance.
 4. Abrasion Resistance of Finish Coat: Sample consisting of 1-inch-thick EIFS mounted on 1/2-inch-thick gypsum board; cured for a minimum of 28 days and shows no cracking, checking, or loss of film integrity after exposure to 528 quarts of sand when tested according to ASTM D 968, Method A.
 5. Mildew Resistance of Finish Coat: Sample applied to 2-by-2-inch clean glass substrate; cured for 28 days and shows no growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274.

2.3 EIFS MATERIALS

- A. Insulation Adhesive: EIFS manufacturer's standard formulation designed for indicated use; compatible with substrate and complying with one of the following:
 1. Job-mixed formulation of portland cement, complying with ASTM C 150/C 150M, Type I, and polymer-based adhesive specified for base coat.
 2. Factory-blended dry formulation of portland cement, dry polymer admixture, and fillers specified for base coat.
 3. Factory-mixed noncementitious formulation designed for adhesive attachment of insulation to substrates of type indicated, as recommended by EIFS manufacturer.
 4. Adhesives shall have a VOC content of 50 g/L or less.
 5. Adhesive 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."

- B. Molded, (Expanded) Rigid Cellular Polystyrene Board Insulation: Comply with ASTM E 2430/E 2430M, unless otherwise noted, and the following:
1. Flame-Spread and Smoke-Developed Indexes: 25 and 450 or less, respectively, according to ASTM E 84.
 2. Dimensions: Provide insulation boards of not more than 24 by 48 inches, with thickness indicated on Drawings.
- C. Reinforcing Mesh: Balanced, alkali-resistant, open-weave, glass-fiber mesh treated for compatibility with other EIFS materials, made from continuous multi-end strands with retained mesh tensile strength of not less than 120 lbf/in. according to ASTM E 2098/E 2098M and the following:
1. Reinforcing Mesh for EIFS, General: Not less than weight required to comply with impact-performance level specified in "Performance Requirements" Article.
 2. Strip-Reinforcing Mesh: As recommended by EIFS manufacturer.
 3. Detail-Reinforcing Mesh: As recommended by EIFS manufacturer.
 4. Corner-Reinforcing Mesh: As recommended by EIFS manufacturer.
- D. Base Coat: EIFS manufacturer's standard mixture complying with one of the following:
1. Job-mixed formulation of portland cement complying with ASTM C 150/C 150M, Type I, white or natural color; and manufacturer's standard polymer-emulsion adhesive designed for use with portland cement.
 2. Job-combined formulation of manufacturer's standard polymer-emulsion adhesive and manufacturer's standard dry mix containing portland cement.
 3. Factory-blended dry formulation of portland cement, dry polymer admixture, and inert fillers to which only water is added at Project site.
 4. Factory-mixed noncementitious formulation of polymer-emulsion adhesive and inert fillers that is ready to use without adding other materials.
 5. Adhesives shall have a VOC content of 50 g/L or less.
 6. Adhesive 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."
- E. Primer: EIFS manufacturer's standard factory-mixed, elastomeric-polymer primer for preparing base-coat surface for application of finish coat.
1. VOC Content: 100 g/L or less.
 2. Low-Emitting Materials: Coatings 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."
- F. Finish Coat: EIFS manufacturer's standard acrylic-based coating complying with the following:
1. Factory-mixed formulation of polymer-emulsion binder, colorfast mineral pigments, sound stone particles, and fillers.
 2. Colors: As scheduled on Drawings.
 3. Textures: As selected by Architect from manufacturer's full range.

- G. Water: Potable.
- H. Trim Accessories: Type as designated or required to suit conditions indicated and to comply with EIFS manufacturer's written instructions; manufactured from UV-stabilized PVC; and complying with ASTM D 1784 and ASTM C 1063.

2.4 MIXING

- A. Comply with EIFS manufacturer's requirements for combining and mixing materials. Do not introduce admixtures, water, or other materials, except as recommended by EIFS manufacturer. Mix materials in clean containers. Use materials within time period specified by EIFS manufacturer or discard.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roof edges, wall framing, flashings, openings, substrates, and junctures at other construction for suitable conditions where EIFS will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Begin coating application only after surfaces are dry.
 - 2. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Protect contiguous work from moisture deterioration and soiling caused by application of EIFS. Provide temporary covering and other protection needed to prevent spattering of exterior finish coats on other work.
- B. Protect EIFS, substrates, and wall construction behind them from inclement weather during installation. Prevent penetration of moisture behind EIFS and deterioration of substrates.
- C. Prepare and clean substrates to comply with EIFS manufacturer's written instructions to obtain optimum bond between substrate and adhesive for insulation.

3.3 EIFS INSTALLATION, GENERAL

- A. Comply with ASTM C 1397, ASTM E 2511, and EIFS manufacturer's written instructions for installation of EIFS as applicable to each type of substrate.

3.4 TRIM INSTALLATION

- A. Trim: Apply trim accessories at perimeter of EIFS, at expansion joints, and elsewhere as indicated. Coordinate with installation of insulation.
1. Drip Screed/Track: Use at bottom edges of EIFS unless otherwise indicated.
 2. Expansion Joint: Use where indicated on Drawings.
 3. Casing Bead: Use at other locations.

3.5 INSULATION INSTALLATION

- A. Board Insulation: Adhesively attach insulation to substrate in compliance with ASTM C 1397 and the following:
1. Sheathing: Apply adhesive to insulation by notched-trowel method in a manner that results in coating the entire surface of sheathing with adhesive once insulation is adhered to substrate. Apply adhesive to a thickness of not less than 1/4 inch for factory mixed and not less than 3/8 inch for field mixed, measured from surface of insulation before placement.
 2. Press and slide insulation into place. Apply pressure over entire surface of insulation to accomplish uniform contact, high initial grab, and overall level surface.
 3. Allow adhered insulation to remain undisturbed for not less than 24 hours, before beginning rasping and sanding insulation or before applying base coat and reinforcing mesh.
 4. Apply insulation over dry substrates in courses, with long edges of boards oriented horizontally.
 5. Begin first course of insulation from screed/track and work upward. Work from perimeter casing beads toward interior of panels if possible.
 6. Stagger vertical joints of insulation boards in successive courses to produce running bond pattern. Locate joints, so no piece of insulation is less than 12 inches wide or 6 inches high.
 - a. Adhesive Attachment: Offset joints of insulation not less than 6 inches from horizontal and 4 inches from vertical joints in sheathing.
 7. Interlock ends at internal and external corners.
 8. Abut insulation tightly at joints within and between each course to produce flush, continuously even surfaces without gaps or raised edges between boards. If gaps greater than 1/16 inch occur, fill with insulation cut to fit gaps exactly; insert insulation without using adhesive or other material.
 9. Cut insulation to fit openings, corners, and projections precisely and to produce edges and shapes complying with details indicated.
 10. Rasp or sand flush entire surface of insulation to remove irregularities projecting more than 1/32 inch from surface of insulation and to remove yellowed areas due to sun exposure; do not create depressions deeper than 1/16 inch. Prevent airborne dispersal and immediately collect insulation raspings or sandings.
 11. Interrupt insulation for expansion joints where indicated.
 12. Form joints for sealant application by leaving gaps between adjoining insulation edges and between insulation edges and dissimilar adjoining surfaces. Make gaps wide enough to produce joint widths indicated after encapsulating joint substrates with base coat and reinforcing mesh.
 13. Form joints for sealant application with back-to-back casing beads for joints within EIFS and with perimeter casing beads at dissimilar adjoining surfaces. Make gaps between

- casing beads and between perimeter casing beads and adjoining surfaces of width indicated.
14. Before installing insulation and before applying field-applied reinforcing mesh, fully wrap board edges. Cover edges of board and extend encapsulating mesh not less than 2-1/2 inches over front and back face unless otherwise indicated on Drawings.
 15. Treat exposed edges of insulation as follows:
 - a. Except for edges forming substrates of sealant joints, encapsulate with base coat, reinforcing mesh, and finish coat.
 - b. Encapsulate edges forming substrates of sealant joints within EIFS or between EIFS and other work with base coat and reinforcing mesh.
 - c. At edges trimmed by accessories, extend base coat, reinforcing mesh, and finish coat over face leg of accessories.
 16. Coordinate installation of flashing and insulation to produce wall assembly that does not allow water to penetrate behind flashing and EIFS lamina.
- B. Expansion Joints: Install at locations indicated, where required by EIFS manufacturer, and as follows:
1. At expansion joints in substrates behind EIFS.
 2. Where EIFS adjoin dissimilar substrates, materials, and construction, including other EIFS.
 3. Where EIFS manufacturer requires joints in long continuous elevations.

3.6 BASE-COAT APPLICATION

- A. Base Coat: Apply full coverage to exposed insulation with not less than 1/16-inch dry-coat thickness.
- B. Reinforcing Mesh: Embed reinforcing mesh in wet base coat to produce wrinkle-free installation with mesh continuous at corners, overlapped not less than 2-1/2 inches or otherwise treated at joints to comply with ASTM C 1397. Do not lap reinforcing mesh within 8 inches of corners. Completely embed mesh, applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are invisible.
- C. Additional Reinforcing Mesh: Apply strip-reinforcing mesh around openings, extending 4 inches beyond perimeter. Apply additional 9-by-12-inch strip-reinforcing mesh diagonally at corners of openings (re-entrant corners). Apply 8-inch-wide, strip-reinforcing mesh at both inside and outside corners unless base layer of mesh is lapped not less than 4 inches on each side of corners.
 1. Embed strip-reinforcing mesh in base coat before applying first layer of reinforcing mesh.

3.7 FINISH-COAT APPLICATION

- A. Primer: Apply over dry base coat.
- B. Finish Coat: Apply full-thickness coverage over dry primed base coat, maintaining a wet edge at all times for uniform appearance, to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.

3.8 CLEANING AND PROTECTION

- A. Remove temporary covering and protection of other work. Promptly remove coating materials from window and door frames and other surfaces outside areas indicated to receive EIFS coatings.

END OF SECTION 072413

SECTION 072500 - WEATHER BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Building wrap.
2. Flexible flashing.

B. Related Requirements:

1. Section 061600 "Sheathing" for sheathing joint and penetration treatment.
2. Section 072713 "Modified Bituminous Sheet Air Barriers" for sheet air barrier applied over wall sheathing.

1.2 SUBMITTALS

A. Product Data: For each type of product.

1. For building wrap, include data on air and water-vapor permeance based on testing according to referenced standards.

PART 2 - PRODUCTS

2.1 WATER-RESISTIVE BARRIER

A. Building Wrap: ASTM E 1677, Type I air barrier; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.

1. Basis of Design: DuPont (E. I. du Pont de Nemours and Company); Tyvek CommercialWrap.
2. Water-Vapor Permeance: Not less than 20 perms per ASTM E 96/E 96M, Desiccant Method (Procedure A).
3. Air Permeance: Not more than 0.001 cfm/sq. ft. at 1.57 psf test pressure when tested according to ASTM E 2178.
4. Allowable UV Exposure Time: Not less than three months.

B. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

2.2 MISCELLANEOUS MATERIALS

A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.040 inch.

1. Basis of Design: DuPont (E. I. du Pont de Nemours and Company); DuPont Flashing Tape.
- B. Primer for Flexible Flashing: Product recommended by manufacturer of flexible flashing for substrate.
- C. Nails and Staples: ASTM F 1667.

PART 3 - EXECUTION

3.1 WATER-RESISTIVE BARRIER INSTALLATION

- A. Cover exposed exterior surface of sheathing with water-resistive barrier securely fastened to framing immediately after sheathing is installed.
- B. Cover sheathing with water-resistive barrier as follows:
 1. Cut back barrier 1/2 inch on each side of the break in supporting members at expansion- or control-joint locations.
 2. Apply barrier to cover vertical flashing with a minimum 4-inch overlap unless otherwise indicated.
- C. Building Wrap: Comply with manufacturer's written instructions.
 1. Seal seams, edges, fasteners, and penetrations with tape.
 2. Extend into jambs of openings and seal corners with tape.

3.2 FLEXIBLE FLASHING INSTALLATION

- A. Apply flexible flashing where indicated to comply with manufacturer's written instructions.
 1. Prime substrates as recommended by flashing manufacturer.
 2. Lap seams and junctures with other materials at least 4 inches except that at flashing flanges of other construction, laps need not exceed flange width.
 3. Lap flashing over water-resistive barrier at bottom and sides of openings.
 4. Lap water-resistive barrier over flashing at heads of openings.
 5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

END OF SECTION 072500

SECTION 072613 - ABOVE-GRADE VAPOR RETARDERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Polyethylene vapor retarders.

B. Related Requirements:

1. Section 072616 "Below-Grade Vapor Retarders" for under-slab vapor retarders.
2. Section 072100 "Thermal Insulation" for vapor retarders integral with insulation products.

1.2 SUBMITTALS

A. Product Data: For each type of product.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

PART 2 - PRODUCTS

2.1 POLYETHYLENE VAPOR RETARDERS

- A. Polyethylene Vapor Retarders: ASTM D 4397, 10-mil thick sheet, with maximum permeance rating of 0.1 perm.

2.2 ACCESSORIES

- A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
- B. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and has demonstrated capability to bond vapor retarders securely to substrates indicated.
- C. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to vapor retarders, including removing projections capable of puncturing vapor retarders.

3.2 INSTALLATION OF VAPOR RETARDERS ON FRAMING

- A. Place vapor retarders on side of construction indicated on Drawings.
- B. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives, vapor retarder fasteners, or other anchorage system as recommended by manufacturer. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
- C. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs and sealing with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Locate all joints over framing members or other solid substrates.
- D. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.
- E. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.3 PROTECTION

- A. Protect vapor retarders from damage until concealed by permanent construction.

END OF SECTION 072613

SECTION 072616 - BELOW-GRADE VAPOR RETARDERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes vapor retarder for installation under concrete slabs on grade.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Verification: 12 inch sample of vapor retarder material.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Protect vapor retarder materials from physical damage and from deterioration by 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: "Stego Wrap 15"; Stego Industries, LLC. Other acceptable products:
 - 1. "Vapor Block 15"; Raven Industries, Inc.
 - 2. "Griffolyn 15 Mil Green"; Reef Industries, Inc.

2.2 VAPOR RETARDER MATERIALS

- A. Vapor Retarder: Multilayer polyolefin sheet material complying with ASTM E 1745, Class A. 15 mil thickness. Less than 0.012 perms according to ASTM E 96.
- B. Seam Tape: Stego's "Stego Tape." 0.3 perms or lower according to ASTM E 96.
- C. Mastic: Stego's "Stego Mastic." 0.3 perms or lower according to ASTM E 96. Fibered Brush and Spray Coats: ASTM D 1227, Type II, Class 1.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions with Installer present, for compliance with requirements for substrates and other conditions affecting performance of work.

- B. Proceed with application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions and ASTM E 1643.
- B. Unroll vapor retarder with longest dimension parallel with direction of the concrete pour.
- C. Lap vapor retarder over footings or seal to foundation walls.
- D. Overlap joints 6 inches and seal with specified tape.
- E. Seal all penetrations according to manufacturer's printed instructions.
- F. No penetration of vapor retarder allow except for reinforcing steel and permanent utilities.
- G. Repair damaged areas by cutting patches of vapor retarder, overlapping damaged area 6 inches and taping all four sides with specified tape.

END OF SECTION 072616

SECTION 072726 - FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Vapor-retarding, fluid-applied air barriers.
 - 2. Vapor-permeable, fluid-applied air barriers.
- B. Related Requirements:
 - 1. Section 061600 "Sheathing" for wall sheathings.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; dry film thickness; and tested physical and performance properties of products.
- B. Sustainable Design Submittals:
 - 1. Product Data: For coatings, indicating VOC content.
 - 2. Laboratory Test Reports: For coatings, indicating compliance with requirements for low-emitting materials.
- C. Shop Drawings: For air-barrier assemblies.
 - 1. Show locations and extent of air-barrier materials, accessories, and assemblies specific to Project conditions.
 - 2. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
 - 3. Include details of interfaces with other materials that form part of air barrier.
- D. Qualification Data: For Installer.
- E. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.
- F. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- B. Protect stored materials from direct sunlight.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended in writing by air-barrier manufacturer.
 - 1. Protect substrates from environmental conditions that affect air-barrier performance.
 - 2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.
- B. VOC Content: 100 g/L or less.
- C. Low-Emitting Materials: Products 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."

2.2 PERFORMANCE REQUIREMENTS

- A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction shall be capable of performing as a continuous air barrier. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
- B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E 2357.
- C. Type of Air Barrier Selection: Contractor to indicate on submittals the type of air barrier (vapor retarding or vapor permeable) required to suit Project requirements, which may include geographical location of Project (climate), building use and occupancy, and related building envelope functions (such as thermal design).

2.3 HIGH-BUILD AIR BARRIERS, VAPOR RETARDING

- A. High-Build, Vapor-Retarding Air Barrier: Synthetic polymer membrane with an installed dry film thickness, according to manufacturer's written instructions, of 35 mils or thicker over smooth, void-free substrates.
1. Synthetic Polymer Type:
 - a. Basis of Design Product: GCP Applied Technologies Inc.; Grace Perm-A-Barrier Liquid.
 2. Physical and Performance Properties:
 - a. Air Permeance: Maximum 0.0002 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
 - b. Vapor Permeance: Maximum 0.08 perm; ASTM E 96/E 96M, Desiccant Method.
 - c. Ultimate Elongation: Minimum 500 percent; ASTM D 412, Die C.
 - d. Adhesion to Substrate: Minimum 16 lbf/sq. in. when tested according to ASTM D 4541.
 - e. UV Resistance: Can be exposed to sunlight for 30 days according to manufacturer's written instructions.

2.4 HIGH-BUILD AIR BARRIERS, VAPOR PERMEABLE

- A. High-Build, Vapor-Permeable Air Barrier: Synthetic polymer membrane with an installed dry film thickness, according to manufacturer's written instructions, of 35 mils or thicker over smooth, void-free substrates.
1. Synthetic Polymer Type:
 - a. Basis of Design Product: GCP Applied Technologies Inc.; Grace Perm-A-Barrier VPL.
 2. Physical and Performance Properties:
 - a. Air Permeance: Maximum 0.0003 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
 - b. Vapor Permeance: Minimum 15 perms; ASTM E 96/E 96M, Desiccant Method, Procedure A.
 - c. Ultimate Elongation: Minimum 200 percent; ASTM D 412, Die C.
 - d. Adhesion to Substrate: Minimum 16 lbf/sq. in. when tested according to ASTM D 4541.
 - e. UV Resistance: Can be exposed to sunlight for 30 days according to manufacturer's written instructions.

2.5 ACCESSORY MATERIALS

- A. Requirement: Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.

- B. Primer: Liquid waterborne primer recommended for substrate by air-barrier material manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
 - 1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
 - 2. Verify that substrates have cured and aged for minimum time recommended in writing by air-barrier manufacturer.
 - 3. Verify that substrates are visibly dry and free of moisture.
 - 4. Verify that masonry joints are flush and completely filled with mortar.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate according to manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.
- B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching material.
- E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
- G. 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.
- H. Bridge isolation joints, expansion joints, and discontinuous joints with air-barrier accessory material that accommodates joint movement according to manufacturer's written instructions and details.

3.3 ACCESSORIES INSTALLATION

- A. Install accessory materials according to air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.

1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
 2. Install transition strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.
 3. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
 4. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
- B. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.
- C. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- D. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames, with not less than 1 inch of full contact.
1. Transition Strip: Roll firmly to enhance adhesion.
- E. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.
- F. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.
- G. Seal top of through-wall flashings to air barrier with an additional 6-inch-wide, transition strip.
- H. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- I. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

3.4 PRIMARY AIR-BARRIER MATERIAL INSTALLATION

- A. Apply air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions and details. Apply air-barrier material within manufacturer's recommended application temperature ranges.
1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
 2. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
 3. Where multiple prime coats are needed to achieve required bond, allow adequate drying time between coats.

- B. High-Build Air Barriers: Apply continuous unbroken air-barrier material to substrates according to the following thickness. Apply air-barrier material in full contact around protrusions such as masonry ties.
 - 1. Vapor-Retarding, High-Build Air Barrier: Total dry film thickness as recommended in writing by manufacturer to comply with performance requirements, but not less than 35 mils, applied in one or more equal coats.
 - 2. Vapor-Permeable, High-Build Air Barrier: Total dry film thickness as recommended in writing by manufacturer to comply with performance requirements, but not less than 35 mils, applied in one or more equal coats.
- C. Do not cover air barrier until it has been tested and inspected by testing agency.
- D. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.5 CLEANING AND PROTECTION

- A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
 - 1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed materials according to air-barrier manufacturer's written instructions.
 - 2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.
- B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended in writing by manufacturer of affected construction.
- C. Remove masking materials after installation.

END OF SECTION 072726

SECTION 074213 - METAL COMPOSITE MATERIAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes metal composite material wall panels.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- B. Shop Drawings:
 - 1. Include fabrication and installation layouts of metal composite material panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment assembly, trim, flashings, closures, and accessories; and special details.
 - 2. Accessories: Include details of the flashing, trim and anchorage, at a scale of not less than 1-1/2 inches per 12 inches.
- C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
 - 1. Metal Composite Material Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal composite material panel accessories.
- D. Qualification Data: For Installer.
- E. Product Test Reports: For each product, tests performed by a qualified testing agency.
- F. Sample Warranties: For special warranties.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal composite material panels, and other manufactured items so as not to be damaged or deformed. Package metal composite material panels for protection during transportation and handling.
- B. Unload, store, and erect metal composite material panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal composite material panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal composite material panels to ensure dryness, with positive slope for drainage of water. Do not store metal composite material panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal composite material panels during installation.

1.6 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal composite material panels to be performed according to manufacturers' written instructions and warranty requirements.

1.7 COORDINATION

- A. Coordinate metal composite material panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal composite material panel systems that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including rupturing, cracking, or puncturing.
 - b. Deterioration of metals and other materials beyond normal weathering.
 - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal composite material panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal composite material panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 330:
 1. Wind Loads: As indicated on Drawings.
 2. Other Design Loads: As indicated on Drawings.
 3. Deflection Limits: For wind loads, no greater than 1/240 of the span.
- B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 283 at the following test-pressure difference:
 1. Test-Pressure Difference: 6.24 lbf/sq. ft.
- C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
 1. Test-Pressure Difference: 6.24 lbf/sq. ft.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing 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 (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METAL COMPOSITE MATERIAL WALL PANELS

- A. Metal Composite Material Wall Panel Systems: Provide factory-formed and -assembled, metal composite material wall panels fabricated from two metal facings that are bonded to a solid, extruded thermoplastic core; formed into profile for installation method indicated. Include attachment assembly components, and accessories required for weathertight system.
 1. Basis-of-Design Product: 3A Composites USA, Inc.; Alucobond. Other acceptable products:
 - a. Alcoa Inc.; Reynobond FR.
 - b. Mitsubishi Plastics Composites America; Inc.; Alpolic/FR.
- B. Aluminum-Faced Composite Wall Panels: Formed with 0.020-inch thick, coil-coated aluminum sheet facings.
 1. Panel Thickness: 0.157 inch.
 2. Core: Fire retardant.
 3. Exterior Finish: Two-coat fluoropolymer.
 - a. Color: As indicated on Drawings.

- C. Attachment Assembly: Manufacturer's standard

2.3 MISCELLANEOUS MATERIALS

- A. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal composite material panels unless otherwise indicated.
- B. Flashing and Trim: Provide flashing and trim formed from same material as metal composite material panels as required to seal against weather and to provide finished appearance. Finish flashing and trim with same finish system as adjacent metal composite material panels.
- C. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal composite material panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- D. Panel Sealants: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal composite material panels and remain weathertight; and as recommended in writing by metal composite material panel manufacturer.

2.4 FABRICATION

- A. General: Fabricate and finish metal composite material panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Fabricate metal composite material panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
 - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 - 3. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
 - 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 - 5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Aluminum Panels and Accessories:
 - 1. Two-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal composite material panel supports, and other conditions affecting performance of the Work.
 - 1. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal composite material wall panel manufacturer.
 - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and assemblies penetrating metal composite material panels to verify actual locations of penetrations relative to seam locations of metal composite material panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal composite material panel manufacturer's written recommendations.

3.3 METAL COMPOSITE MATERIAL PANEL INSTALLATION

- A. General: Install metal composite material panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to supports unless otherwise indicated. Anchor metal composite material panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Shim or otherwise plumb substrates receiving metal composite material panels.
 - 2. Flash and seal metal composite material panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal composite material panels are installed.
 - 3. Install screw fasteners in predrilled holes.
 - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 - 5. Install flashing and trim as metal composite material panel work proceeds.
 - 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 - 7. Align bottoms of metal composite material panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 - 8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
 - 1. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal composite material panel manufacturer.
- D. Attachment Assembly, General: Install attachment assembly required to support metal composite material wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.
 - 1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.
- E. Installation: Attach metal composite material wall panels to supports at locations, spacings, and with fasteners recommended by manufacturer to achieve performance requirements specified.
 - 1. Wet Seal Systems: Seal horizontal and vertical joints between adjacent metal composite material wall panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Section 079200 "Joint Sealants."
 - 2. Rainscreen Systems: Do not apply sealants to joints unless otherwise indicated.
- F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal composite material panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal composite material panel manufacturer; or, if not indicated, provide types recommended in writing by metal composite material panel manufacturer.
- G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.
1. Install exposed flashing and trim that is without buckling and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof performance.
 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.4 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal composite material wall panel units within installed tolerance of 1/4 inch in 20 feet non-accumulative, on level, plumb, and location lines as indicated, and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.5 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal composite material panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal composite material panel installation, clean finished surfaces as recommended by metal composite material panel manufacturer. Maintain in a clean condition during construction.
- B. After metal composite material panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal composite material panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074213

SECTION 074243 - PHENOLIC CLADDING WALL PANEL SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes exterior phenolic cladding wall system and accessories as required to provide complete drained and back-ventilated rainscreen system.

1.2 SUBMITTALS

- A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- B. Shop Drawings: Include fabrication and installation layouts of panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment assembly, trim, flashings, closures, and accessories; and special details.
 - 1. Accessories: Include details of the flashing, trim and anchorage, at a scale of not less than 1-1/2 inches per 12 inches.
- C. Samples for Verification: For each finish product specified, two 3-1/2 inch square samples representative of the actual product, finishes, and colors.
- D. Qualification Data: For Installer.
- E. Product Test Reports: For each product, tests performed by a qualified testing agency.
- F. Sample Warranties: For special warranties.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer, with minimum three years of documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, panels, and other manufactured items so as not to be damaged or deformed. Package panels for protection during transportation and handling.
- B. Unload, store, and erect panels in a manner to prevent bending, warping, twisting, and surface damage.

- C. Stack panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store panels to ensure dryness, with positive slope for drainage of water. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on panels during installation.

1.6 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of panels to be performed according to manufacturers' written instructions and warranty requirements.
- B. Field Measurements: Verify actual measurements by field measuring prior to release for shop fabrication. Indicate recorded measurements on shop drawings. Coordinate field measuring and fabrication schedule with construction progress and schedule to avoid construction delays.

1.7 COORDINATION

- A. Coordinate panel installation with rain drainage work, flashing, trim, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of phenolic cladding wall panel systems that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including rupturing, cracking, or puncturing.
 - b. Deterioration of metals and other materials beyond normal weathering.
 - 2. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Trespa International B.V.; Trespa FR Meteon. Represented by Trespa North America, Ltd.

2.2 WALL PANELS

- A. Panel Material: Manufactured solid panel using a combination of high pressure and temperature to create a flat panel based on thermosetting resins, homogeneously reinforced with wood-based fibers and integrated decorative surface color and finish.
- B. Color and Finish; Custom color as indicated on Drawings. Satin sheen.
- C. Panel Thickness: 8.0 mm.
- D. Panel Corner Profile: 143.70 inches by 11.81 inches by 11.81 inches with a 3/8 inch thick by 3/4 inch radius.
- E. Fire Performance:
 - 1. Flamespread: Class A; ASTM E 84.
 - 2. Smoke Development: Less than 450; ASTM E 84.
 - 3. Ignition Temperature: Greater than 650 deg F above ambient; ASTM D 1929.
 - 4. Burning Classification: CC1 or CC2; ASTM D 635.
- F. Finish Performance:
 - 1. Humidity Resistance: No formation of blisters when subjected to condensing water at 100 percent relative humidity and 100 deg F for 3000 hours; ASTM D 2247.
 - 2. Salt Spray Resistance: Corrosion creepage from scribe line (1/16 inch maximum) and minimum blister rating of 8 within the test specimen field; ASTM B 117.
 - 3. Weather Exposure: Accelerated - 3000 hours in Atlas Type Weatherometer using cycle of 90 minutes light and 30 minutes diminished light and demineralized water with a maximum color change of 5 Delta E units from original color; ASTM D 2244.
 - 4. Microbial Characteristics: Will not support micro-organic growth.

2.3 ACCESSORIES

- A. Mounting System:
 - 1. General: Trespa TS210 concealed fastening system on fixed depth aluminum subframing.
 - 2. Aluminum Subframing: Designed to withstand Project wind load pressures and panel dead load. Painted as required to conceal behind the open joinery of the attachment system.
 - 3. Extrusions, including corner closures, joint closures, and vent screens, formed members, sheet, and plate to conform to manufacturer's requirements.
- B. Extruded Aluminum Trim: ASTM B 209 extrusions; manufacturer's recommended alloy and temper. Color to match panels unless otherwise indicated on Drawings.

2.4 FABRICATION

- A. Panels: Solid phenolic-impregnated kraft paper wall panels with no voids, air spaces, or foamed insulation in the core material.
- B. Panel Bow: 0.079 inch per 39.38 inches.
- C. Panel Dimensions: Field fabrication allowed only as necessary and kept at a minimum.
- D. Appearance: Panel lines, breaks, and angles shall be sharp and true, with surfaces free from warp and buckle.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, panel supports, and other conditions affecting performance of the Work.
 - 1. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by panel manufacturer.
 - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and assemblies penetrating panels to verify actual locations of penetrations relative to seam locations of panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation, according to manufacturer's written instructions.

3.3 PANEL INSTALLATION

- A. General: Install panels according to manufacturer's written instructions and approved shop drawings.
- B. Install solid phenolic wall panels plumb and level.
- C. Anchor panels and subframing securely to installation substrates, allowing for necessary movement and structural support.
- D. Fasten panels with fasteners approved by manufacturer for attachment substrates.
- E. Do not install panels or component parts that are observed to be defective or damaged including, but not limited to, warpage, bowing, abraded or scratched surfaces, and broken members.

- F. Do not cut or trim components parts during installation in a manner that could damage panel finish, decrease panel strength, or result in visual imperfection or a failure in performance. Replace component parts that cannot be successfully repaired in the shop.
- G. Install corner profiles and trim with fasteners appropriate for use with adjoining construction as indicated on Drawings and as recommended by panel manufacturer.

3.4 ADJUSTING AND CLEANING

- A. Remove masking or other panel protection as soon as possible after installation.
- B. Adjust final panel installation so that all joints are true and even throughout installation. Panels out of plane shall be adjusted with the surrounding panels to minimize any imperfection.
- C. Repair panels with minor damage, and as acceptable to Architect. Remove and replace panels that cannot be successfully repaired.
- D. Clean finished surfaces as recommended by panel manufacturer.

END OF SECTION 0742413

SECTION 075423 - THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Adhered thermoplastic polyolefin (TPO) roofing system.
2. Roof insulation.

B. Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, and blocking.
2. Section 076200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
3. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
4. Division 22 - Plumbing Section for roof drains.

1.2 DEFINITIONS

- A. Roofing Terminology: Definitions in ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Roofing Conference: Conduct conference at Project site.

1. 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.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.4 SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. Product Test Reports: For roof materials, documentation indicating that roof materials comply with Solar Reflectance Index requirements.
 - 2. Product Data: For adhesives and sealants, indicating VOC content.
 - 3. Laboratory Test Reports: For adhesives and sealants, indicating compliance with requirements for low-emitting materials.
 - 4. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 5. Environmental Product Declaration: For each product.
 - 6. Health Product Declaration: For each product.
 - 7. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.
- C. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work, including:
 - 1. Base flashings and membrane terminations.
 - 2. Tapered insulation, including slopes.
 - 3. Roof plan showing orientation of steel roof deck and orientation of roofing, fastening spacings, and patterns for mechanically fastened roofing.
 - 4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
- D. Qualification Data: For Installer.
- E. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - 1. Submit evidence of compliance with performance requirements.
- F. Product Test Reports: For components of roofing system, tests performed by manufacturer and witnessed by a qualified testing agency.
- G. Research/Evaluation Reports: For components of roofing system, from ICC-ES.
- H. Field quality-control reports.
- I. Sample Warranties: For manufacturer's special warranties.
- J. Maintenance Data: For roofing system to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.6 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.
 - 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. 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.
- D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.7 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.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
 - 1. Special warranty includes roofing, base flashings, roof insulation, fasteners, cover boards, roofing accessories, and other components of roofing system.
 - 2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Firestone Building Products Co.; UltraPly. Other acceptable manufacturers:
 - 1. Carlisle SynTec Incorporated.
 - 2. GAF Materials Corporation.
 - 3. Johns Manville.
- B. Source Limitations: Obtain components including roof insulation and fasteners for roofing system from same manufacturer as membrane roofing or manufacturer approved by membrane roofing manufacturer.

2.2 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 G 154, or ASTM G 155.
 - 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 indicated on Drawings.
- D. Solar Reflectance Index: Not less than 78 when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.
- E. Exterior Fire-Test Exposure: ASTM E 108 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.

2.3 TPO ROOFING

- A. Fabric-Reinforced TPO Sheet: ASTM D 6878, internally fabric- or scrim-reinforced, uniform, flexible TPO sheet.
 - 1. Thickness: 60 mils, nominal.
 - 2. Exposed Face Color: White.
 - 3. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

2.4 AUXILIARY ROOFING MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing.
 - 1. Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction.
 - 2. Adhesives and sealants shall comply with the following limits for VOC content:
 - a. Plastic Foam Adhesives: 50 g/L.
 - b. Gypsum Board and Panel Adhesives: 50 g/L.
 - c. Multipurpose Construction Adhesives: 70 g/L.
 - d. Fiberglass Adhesives: 80 g/L.
 - e. Contact Adhesives: 80 g/L.
 - f. PVC Welding Compounds: 510 g/L.
 - g. Other Adhesives: 250 g/L.
 - h. Single-Ply Roof Membrane Sealants: 450 g/L.
 - i. Nonmembrane Roof Sealants: 300 g/L.

- j. Sealant Primers for Nonporous Substrates: 250 g/L.
 - k. Sealant Primers for Porous Substrates: 775 g/L.
3. Adhesives and sealants 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."
- B. Sheet Flashing: Manufacturer's standard unreinforced TPO sheet flashing, 55 mils thick, minimum, of same color as TPO sheet.
 - C. Bonding Adhesive: Manufacturer's standard.
 - D. Slip Sheet: Manufacturer's standard, of thickness required for application.
 - E. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roofing to substrate, and acceptable to roofing system manufacturer.
 - F. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.5 ROOF INSULATION

- A. General: Preformed roof insulation boards manufactured or approved by TPO roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.
- B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.
 - 1. Basis-of-Design Manufacturer: Firestone Building Products. Other acceptable manufacturers:
 - a. Atlas Roofing Corporation.
 - b. Carlisle SynTec Incorporated.
 - c. GAF Materials Corporation.
 - d. Hunter Panels.
 - e. Johns Manville.
- C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches unless otherwise indicated.
- D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.6 INSULATION ACCESSORIES

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with roofing.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.
- C. Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/2 inch thick.
 - 1. Basis of Design: Georgia-Pacific Corporation; Dens Deck.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work:
 - 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 wood 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 Section 053100 "Steel Decking."
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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.

3.3 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 in to existing roofing to maintain weathertightness of transition.

3.4 INSULATION INSTALLATION

- A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.
- C. Install tapered insulation under area of roofing to conform to slopes indicated.
- D. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.
- E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.
 - 1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
- G. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
 - 1. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.
- H. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction. Loosely butt cover boards together and fasten to roof deck.
 - 1. Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.

3.5 ADHERED ROOFING INSTALLATION

- A. Adhere roofing over area to receive roofing according to roofing system manufacturer's written instructions. Unroll roofing and allow to relax before retaining.
- B. Start installation of roofing in presence of roofing system manufacturer's technical personnel.
- C. Accurately align roofing, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- D. Bonding Adhesive: Apply to substrate and underside of roofing at rate required by manufacturer, and allow to partially dry before installing roofing. Do not apply to splice area of roofing.
- E. In addition to adhering, mechanically fasten roofing securely at terminations, penetrations, and perimeter of roofing.
- F. Apply roofing with side laps shingled with slope of roof deck where possible.

- G. Seams: Clean seam areas, overlap roofing, and hot-air weld side and end laps of roofing and sheet flashings according to manufacturer's written instructions, to ensure a watertight seam installation.
 - 1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet.
 - 2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
 - 3. Repair tears, voids, and lapped seams in roofing that do not comply with requirements.
- H. Spread sealant bed over deck-drain flange at roof drains, and securely seal roofing in place with clamping ring.

3.6 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.

3.7 WALKWAY INSTALLATION

- A. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.8 FIELD QUALITY CONTROL

- A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
- B. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.

3.9 PROTECTING AND CLEANING

- A. 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.
- B. 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.

- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 075423

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Formed low-slope roof sheet metal fabrications.

B. Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section 075423 "Thermoplastic Polyolefin (TPO) Roofing."
3. Section 077200 "Roof Accessories" for roof hatch.

1.2 COORDINATION

- A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
- B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.3 SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

C. Shop Drawings: Include plans, elevations, sections, and attachment details. Detail fabrication and installation layouts, and keyed details. Distinguish between shop- and field-assembled work.

1. Include identification of material, thickness, weight, and finish for each item and location in Project.
2. Include details for forming, including profiles, shapes, seams, and dimensions.
3. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
4. Include details of edge conditions.
5. Include details of connections to adjoining work.
6. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches.

- D. Samples for Verification: For each type of exposed finish.
 - 1. Sheet Metal Flashing: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
- E. Qualification Data: For fabricator.
- F. Product Certificates: For each type of coping and roof edge flashing that is SPRI ES-1 tested.
- G. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- H. Sample Warranty: For special warranty.

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
 - 1. For copings and roof edge flashings that are SPRI ES-1 tested, shop shall be listed as able to fabricate required details as tested and approved.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.6 WARRANTY

- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 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" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. SPRI Wind Design Standard: Manufacture and install copings tested according to SPRI ES-1 and capable of resisting the following design pressure:
 - 1. Design Pressure: As indicated on Drawings.
- D. 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 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with [smooth, flat] [embossed] surface.
 - 1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
 - 2. As-Milled Finish: Mill.
 - 3. Clear Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker. Provide for building copings.
 - 4. Exposed Coil-Coated Finish:
 - a. Two-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - b. Provide for canopy copings.
 - 5. Color: As indicated on Drawings.
 - 6. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

2.3 UNDERLAYMENT MATERIALS

- A. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.
- B. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. minimum.

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners[, solder], protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.
 - 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
 - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 - 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
- C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
- D. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- F. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- G. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.
- H. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.5 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.

1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 2. Obtain field measurements for accurate fit before shop fabrication.
 3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
- D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.
- G. Seams for Uncoated Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.]
- H. Do not use graphite pencils to mark metal surfaces.

2.6 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Copings: Fabricate in minimum 96-inch long, but not exceeding 12-foot long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external and interior legs. Miter corners, fasten and seal watertight. Shop fabricate interior and exterior corners.
1. Coping Profile: As indicated on Drawings.
 2. Joint Style: Butted with expansion space and 6-inch wide, concealed backup plate.
 3. Fabricate from the Following Materials:
 - a. Aluminum: 0.063 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
1. Verify compliance with requirements for installation tolerances of substrates.

2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

- A. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches (50 mm).
- B. Apply slip sheet, wrinkle free, over underlayment before installing sheet metal flashing and trim.

3.3 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
 4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
 5. Torch cutting of sheet metal flashing and trim is not permitted.
 6. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
1. Coat concealed side of uncoated-aluminum sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
 2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
 2. Use lapped expansion joints only where indicated on Drawings.

- D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction.
 - 1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
 - 2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

3.4 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
- B. Copings: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated.
 - 1. Interlock exterior and interior bottom edge of coping with continuous cleat anchored to substrate at 24-inch centers.

3.5 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.6 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean off excess sealants.
- C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.

- D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 076200

SECTION 077200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof curbs.
2. Roof hatch.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for metal vertical ladder for access to roof hatch.

1.2 PERFORMANCE REQUIREMENTS

- A. General Performance: 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.

1.3 SUBMITTALS

- A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For roof accessories. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.
- C. Samples: For each exposed product and for each color and texture specified, prepared on Samples of size to adequately show color.
- D. Warranty: Sample of special warranty.
- E. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.4 COORDINATION

- A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.
- B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

PART 2 - PRODUCTS

2.1 METAL MATERIALS

- A. Aluminum Sheet: ASTM B 209, manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.
 - 1. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
- B. Aluminum Extrusions and Tubes: ASTM B 221, manufacturer's standard alloy and temper for type of use, finished to match assembly where used, otherwise mill finished.
- C. Steel Tube: ASTM A 500, round tube.
- D. Galvanized-Steel Tube: ASTM A 500, round tube, hot-dip galvanized according to ASTM A 123/A 123M.
- E. Steel Pipe: ASTM A 53/A 53M, galvanized.

2.2 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Polyisocyanurate Board Insulation: ASTM C 1289, thickness as indicated.
- C. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWWA C2; not less than 1-1/2 inches thick.
- D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.
- E. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
 - 1. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
- F. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.
- G. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.
- H. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.
- I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.3 ROOF CURBS

- A. Roof Curbs: Internally reinforced roof-curb units capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings; with welded or mechanically fastened and sealed corner joints, and integrally formed deck-mounting flange at perimeter bottom.
 - 1. Manufacturers: Provide products by one of the following:
 - a. Greenheck Fan Corporation.
 - b. LM Curbs.
 - c. Metallic Products Corp.
 - d. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
 - e. Pate Company (The).
 - f. Roof Products, Inc.
 - g. Thybar Corporation.
- B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.
- C. Material: Aluminum sheet, 0.090 inch thick.
 - 1. Finish: Clear anodic.
- D. Construction:
 - 1. Insulation: Factory insulated with 1-1/2-inch thick glass-fiber board insulation.
 - 2. Liner: Same material as curb, of manufacturer's standard thickness and finish.
 - 3. Factory-installed wood nailer at top of curb, continuous around curb perimeter.
 - 4. Fabricate curbs to minimum height of 12 inches unless otherwise indicated.
 - 5. Top Surface: Level around perimeter with roof slope accommodated by sloping the deck-mounting flange.

2.4 ROOF HATCH

- A. Roof Hatches: Metal roof-hatch unit with lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, and integrally formed deck-mounting flange at perimeter bottom.
 - 1. Basis-of-Design Product: Bilco Company (The); Model S-20. Other acceptable manufacturers:
 - a. Babcock-Davis.
 - b. J. L. Industries, Inc.
 - c. Metallic Products Corp.
 - d. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
 - e. Nystrom.
 - f. O'Keeffe's Inc.
 - g. Pate Company (The).
- B. Type and Size: Single-leaf lid, 30 by 36 inches.
- C. Loads: Minimum 40-lbf/sq. ft. external live load and 20-lbf/sq. ft. internal uplift load.

- D. Hatch Material: Aluminum sheet, 0.090 inch thick.
 - 1. Finish: Clear anodic.
- E. Construction:
 - 1. Insulation: Glass-fiber or polyisocyanurate board.
 - 2. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
 - 3. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
 - 4. Fabricate curbs to minimum height of 12 inches unless otherwise indicated.
- F. Hardware: Stainless-steel spring latch with turn handles, butt- or pintle-type hinge system, and padlock hasps inside and outside.
- G. Ladder-Assist Post: Roof-hatch manufacturer's standard device for attachment to roof-access ladder.
 - 1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
 - 2. Height: 42 inches above finished roof deck.
 - 3. Material: Steel tube.
 - 4. Post: 1-5/8-inch diameter pipe.
 - 5. Finish: Manufacturer's standard baked enamel or powder coat.
 - a. Color: As selected by Architect from manufacturer's full range.

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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- C. Verify dimensions of roof openings for roof accessories.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install roof accessories according to manufacturer's written instructions.
 - 1. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
 - 2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
 - 3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
 - 4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 - 1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene sheet.
 - 3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.
- C. Roof Curb Installation: Install each roof curb so top surface is level.
- D. Roof-Hatch Installation:
 - 1. Install roof hatch so top surface of hatch curb is level.
 - 2. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
 - 3. Attach ladder-assist post according to manufacturer's written instructions.

3.3 REPAIR AND CLEANING

- A. Clean exposed surfaces according to manufacturer's written instructions.
- B. Clean off excess sealants.
- C. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077200

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Urethane joint sealants.
3. Latex joint sealants.
4. Acoustical joint sealants.

B. Related Requirements:

1. Section 092900 "Gypsum Board" for sealing perimeter joints.
2. Section 095113 "Acoustical Panel Ceilings" for sealing edge moldings at perimeters with acoustical sealant.

1.2 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Sustainable Design Submittals:

1. Product Data: For sealants, indicating VOC content.
2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

C. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

D. Qualification Data: For qualified Installer.

E. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.

F. Warranties: Sample of special warranties.

1.3 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 each kind of joint sealant from single source from single manufacturer.

1.4 PROJECT 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.

1.5 WARRANTY

- A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: 10 years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 2. Disintegration of joint substrates from natural causes exceeding design specifications.
 3. Mechanical damage caused by individuals, tools, or other outside agents.
 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MATERIALS, 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. VOC Content: Sealants and sealant primers shall comply with the following:
1. Architectural sealants shall have a VOC content of 250 g/L or less.
 2. Sealants and sealant primers for nonporous substrates shall have a VOC content of 250 g/L or less.
 3. Sealants and sealant primers for porous substrates shall have a VOC content of 775 g/L or less.

4. Sealant 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."
- C. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
- D. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

- A. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT.
 1. Products: Provide one of the following:
 - a. BASF Building Systems; Omniseal 50.
 - b. Dow Corning Corporation; 795.
 - c. GE Advanced Materials - Silicones; SilGlaze II SCS2800.
 - d. Tremco Incorporated; Spectrem 2.
- B. Mildew-Resistant, Single-Component, Acid-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
 1. Products: Provide one of the following:
 - a. BASF Building Systems; Omniplus.
 - b. Dow Corning Corporation; 786 Mildew Resistant.
 - c. GE Advanced Materials - Silicones; Sanitary SCS1700.
 - d. Tremco Incorporated; Tremsil 200 Sanitary.

2.3 URETHANE JOINT SEALANTS

- A. Multicomponent, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use T.
 1. Products: Provide one of the following:
 - a. BASF Building Systems; Sonolastic NP 2.
 - b. Pecora Corporation; Dynatred.
 - c. Sika Corporation, Construction Products Division; Sikaflex - 2c NS.
 - d. Tremco Incorporated; Vulkem 227.

2.4 LATEX JOINT SEALANTS

- A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
 1. Products: Provide one of the following:
 - a. BASF Building Systems; Sonolac.

- b. Pecora Corporation; AC-20+.
- c. Tremco Incorporated; Tremflex 834.

2.5 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Products: Provide one of the following:

- a. Pecora Corporation; AC-20 FTR.
- b. USG Corporation; SHEETROCK Acoustical Sealant.

2.6 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, 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.
- 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.

2.7 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.

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.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions 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 porous joint substrate surfaces by brushing, grinding, 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 after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. 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 or primer 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 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
 2. Do not stretch, twist, puncture, or tear sealant backings.
 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
1. Place sealants so they directly contact and fully wet joint substrates.
 2. Completely fill recesses in each joint configuration.
 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 3. Provide concave joint profile.
- G. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, 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. Comply with ASTM C 919 and with manufacturer's written recommendations.

3.4 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants 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 installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.
 - 1. Joint Locations:
 - a. Isolation and contraction joints in cast-in-place concrete slabs.
 - b. Other joints as indicated.
 - 2. Joint Sealant: Multicomponent, nonsag, traffic grade, Class 25.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 1. Joint Locations:
 - a. Construction joints in cast-in-place concrete.
 - b. Control and expansion joints in unit masonry.
 - c. Joints in dimension architectural stone veneer.
 - d. Joints between different materials listed above.
 - e. Perimeter joints between materials listed above and frames of doors and windows.
 - f. Other joints as indicated.
 - 2. Silicone Joint Sealant: Single component, nonsag, neutral curing, Class 50.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
 - 1. Joint Locations:
 - a. Isolation joints in cast-in-place concrete slabs.
 - b. Control and expansion joints in tile flooring.
 - c. Other joints as indicated.
 - 2. Urethane Joint Sealant: Multicomponent, nonsag, traffic grade, Class 25.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 1. Joint Locations:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints of exterior openings where indicated.
 - c. Perimeter joints between interior wall surfaces and frames of interior doors.
 - d. Other joints as indicated.
 - 2. Joint Sealant: Latex.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

- E. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 1. Joint Sealant Location:
 - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - b. Other joints as indicated.
 - 2. Joint Sealant: Single component, nonsag, mildew resistant, acid curing.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- F. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces.
 - 1. Joint Location:
 - a. Acoustical joints where indicated.
 - b. Other joints as indicated.
 - 2. Joint Sealant: Acoustical.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes hollow-metal work.
- B. Related Requirements:
 - 1. Section 081416 "Flush Wood Doors" for wood doors installed in hollow metal frames.
 - 2. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.

1.2 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.3 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.4 SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, and finishes.
- B. Sustainable Design Submittals:
 - 1. Product Data: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
- C. Shop Drawings: Include the following:
 - 1. Elevations of each door type.
 - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 4. Locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of anchorages, joints, field splices, and connections.
 - 7. Details of accessories.
 - 8. Details of conduit and preparations for power, signal, and control systems.

- D. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
 - 1. Provide additional protection to prevent damage to factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Provide products by the following:
 - 1. Amweld International, LLC.
 - 2. Ceco Door Products.
 - 3. Karpen Steel Custom Doors & Frames.
 - 4. Pioneer Industries, Inc.
 - 5. Republic Doors and Frames.
 - 6. Steelcraft.
- B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 INTERIOR FRAMES

- A. Construct interior frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Extra-Heavy-Duty Frames: SDI A250.8, Level 3.
 - 1. Physical Performance: Level A according to SDI A250.4.
 - 2. Frames:
 - a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch.
 - b. Construction: Full profile welded.
 - 3. Exposed Finish: Prime.

2.3 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

- A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3.
 - 1. Physical Performance: Level A according to SDI A250.4.
 - 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 coating.
 - d. Edge Construction: Model 1, Full Flush].
 - e. Core: Polyurethane or polyisocyanurate.
 - 1) Thermal-Rated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than 2.1 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.
- 3. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 coating.
 - b. Construction: Full profile welded.
- 4. Exposed Finish: Prime.

2.4 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
 - 2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
- B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch, and as follows:
 - 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.5 MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- C. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- D. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- E. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- F. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- G. 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.
- H. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.
- I. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- J. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.6 FABRICATION

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Hollow-Metal Doors:

1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch, steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches apart. Spot weld to face sheets no more than 5 inches o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
2. Vertical Edges for Single-Acting Doors: Bevel edges 1/8 inch in 2 inches.
3. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets.
4. Bottom Edge Closures: Close bottom edges of doors with end closures or channels of same material as face sheets.
5. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.

C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
2. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
3. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
4. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 32 inches o.c., to match coursing, and as follows:
 - 1) Three anchors per jamb from 60 to 90 inches high.
 - b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Four anchors per jamb from 60 to 90 inches high.
5. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.

D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.

E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

2.7 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
 - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.8 ACCESSORIES

- A. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.
- B. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

- a. Install door silencers in frames before grouting.
 - b. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - c. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - d. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.
- 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
- 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
- 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
- 5. 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, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - 1. Non-Fire-Rated Steel Doors:
 - a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.
 - b. At Bottom of Door: 3/4 inch plus or minus 1/32 inch.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow-metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 081113

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-core doors with wood veneer faces.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

B. Related Requirements:

1. Section 081113 "Hollow Metal Doors and Frames."
2. Section 087100 "Door Hardware."

1.2 SUBMITTALS

A. Product Data: For each type of door. Include details of core and edge construction.

B. Sustainable Design Submittals:

1. Product Certificates: For products and materials required to comply with requirements for regional materials, certificates indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating distance to Project, cost for each regional material, and fraction by weight that is considered regional.
2. Certificates: Chain-of-custody certificates indicating that flush wood doors comply with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.
3. Product Data: For adhesives and composite wood products, documentation indicating that product contains no urea formaldehyde.

C. 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.
2. Dimensions and locations of mortises and holes for hardware.
3. Dimensions and locations of cutouts.
4. Undercuts.

D. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.

E. Sample Warranty: For special warranty.

- F. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.3 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 Quality Certification Program.
- B. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in plastic bags or cardboard cartons.
- C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.5 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 ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

1.6 WARRANTY

- A. 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 in a 42-by-84-inch section.
 - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
 - 2. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design Manufacturer: Oshkosh Door Company.

2.2 FLUSH WOOD DOORS, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with AWI's, AWMAC's, and WI's "Architectural Woodwork Standards."
 - 1. Provide AWI Quality Certification Labels indicating that doors comply with requirements of grades specified.
- B. Regional Materials: Flush wood doors shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- C. Certified Wood: Flush wood doors shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship," and to FSC STD-40-004, "FSC Standard for Chain of Custody Certification."
- D. Low-Emitting Materials: Fabricate doors with adhesives and composite wood products that do not contain urea formaldehyde.
- E. WDMA I.S. 1-A Performance Grade: Extra Heavy Duty.
- F. Structural-Composite-Lumber-Core Doors:
 - 1. Structural Composite Lumber: WDMA I.S.10.
 - a. Screw Withdrawal, Face: 700 lbf.
 - b. Screw Withdrawal, Edge: 400 lbf.

2.3 VENEER-FACED DOORS FOR TRANSPARENT FINISH

- A. Interior Solid-Core Doors:
 - 1. Grade: Premium, with Grade A faces.
 - 2. Species and Cut: Rift cut white oak.
 - 3. Match between Veneer leaves: Book match.
 - 4. Exposed Vertical Edges: Same spaces as faces - edge Type A.
 - 5. Core: Either glued wood stave or structural composite lumber.
 - 6. Construction: Five or seven plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering.

2.4 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.
 - 1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.

2.5 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 bottom edges, edges of cutouts, and mortises.
- B. Factory finish doors.
- C. Transparent Finish:
 - 1. Grade: Premium.
 - 2. Finish: AWI's, AWMAC's, and WI's "Architectural Woodwork Standards" System 10, UV curable, water based.
 - 3. Staining: As indicated on Drawings or as selected by Architect from manufacturer's full range.
 - 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.

3.2 INSTALLATION

- A. Hardware: For installation, see Section 087100 "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
- C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

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 081416

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes access doors and frames for walls and ceilings.
- B. Related Requirements:
 - 1. Section 077200 "Roof Accessories" for roof hatches.

1.2 SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Product Schedule: For access doors and frames. Use same designations indicated on Drawings.

PART 2 - PRODUCTS

2.1 ACCESS DOORS AND FRAMES

- A. Flush Access Doors with Concealed Flanges:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Acudor Products, Inc.
 - b. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - c. Larsens Manufacturing Company.
 - d. Milcor; Commercial Products Group of Hart & Cooley, Inc.
 - e. Nystrom, Inc.
 - 2. Description: Face of door flush with frame; with concealed flange for gypsum board installation and concealed hinge.
 - 3. Locations: Ceiling.
 - 4. Door Size: As indicated on Drawings.
 - 5. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch, factory primed.
 - 6. Frame Material: Same material and thickness as door thickness, and finish.
 - 7. Latch and Lock: Latch bolt, key operated.

2.2 MATERIALS

- A. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.
- B. Frame Anchors: Same material as door face.
- C. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

2.3 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 mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.
- D. Latch and Lock Hardware:
 - 1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
 - 2. Keys: Furnish two keys per lock and key all locks alike.

2.4 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. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - 1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates 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. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 083113

SECTION 083326 - OVERHEAD COILING GRILLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Closed-curtain overhead coiling grilles.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for miscellaneous steel supports.

1.2 SUBMITTALS

A. Product Data: For each type and size of overhead coiling grille and accessory.

1. Include construction details, material descriptions, dimensions of individual components, profiles for curtain components, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
4. Show locations of controls, locking devices, and other accessories.
5. Include diagrams for power, signal, and control wiring.

C. Qualification Data: For Installer.

D. Maintenance Data: For overhead coiling grilles to include in maintenance manuals.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

PART 2 - PRODUCTS

2.1 CLOSED-CURTAIN GRILLE ASSEMBLY

- A. Closed-Curtain Grille: Overhead coiling grille with a curtain having a series of horizontal ribs alternating with continuous horizontal infill panels secured by the ribs.
 - 1. Basis-of-Design Product: QMI Security Solutions; Transparoll Roll Up Grille.
- B. Operation Cycles: Grille components and operators capable of operating for not less than 20,000. One operation cycle is complete when a grille is opened from the closed position to the fully open position and returned to the closed position.
- C. Grille Curtain Material: Aluminum ribs with continuous inserts indicated.
 - 1. Rib Spacing: Manufacturer's standard.
 - 2. Inserts: Clear, transparent plastic panels.
- D. Bottom Bar: Continuous tubular shape, fabricated from aluminum extrusion and finished to match grille.
- E. Curtain Jamb Guides: Aluminum with exposed finish matching curtain slats. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise.
- F. Hood: Match curtain material and finish.
 - 1. Shape: Square.
 - 2. Mounting: As indicated on Drawings.
- G. Electric Grille Operator:
 - 1. Usage Classification: Medium duty, up to 12 cycles per hour and up to 50 cycles per day.
 - 2. Operator Location: Front of hood.
 - 3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use.
 - 4. Motor Exposure: Interior.
 - 5. Emergency Manual Operation: Manufacturer's standard.
 - 6. Control Station: Where indicated on Drawings.
- H. Grille Finish:
 - 1. Aluminum Finish: Clear anodized.

2.2 MATERIALS, GENERAL

- 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.

2.3 GRILLE CURTAIN MATERIALS AND CONSTRUCTION

- A. Closed-Curtain Grilles: Fabricate curtain as a series of horizontal double-C ribs, spaced at regular intervals, that alternate with continuous horizontal infill panels secured by the ribs.
 - 1. Aluminum Horizontal Ribs: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
 - 2. Plastic Panels: Fire-retardant polycarbonate sheet manufactured by the extrusion process; UV resistant; manufacturer's standard panel dimensions and thickness.
- B. Bottom Bar: Manufacturer's standard continuous shape, finished to match grille.
 - 1. Astragal: Equip grille bottom bar with a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene as a cushion bumper.
- C. Grille Curtain Jamb Guides: Manufacturer's standard shape having curtain groove with return lips or bars to retain curtain. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise; with removable stops on guides to prevent overtravel of curtain.

2.4 HOODS AND ACCESSORIES

- A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
 - 1. Aluminum: 0.040-inch thick aluminum sheet, complying with ASTM B 209, of alloy and temper recommended by manufacturer and finisher for type of use and finish indicated.
- B. Mounting Frame: Manufacturer's standard mounting frame designed to support grille; factory fabricated from ASTM A 36/A 36M structural-steel tubes [shapes], hot-dip galvanized per ASTM A 123/A 123M; fastened to floor and structure above grille; to be built into wall construction; and complete with anchors, connections, and fasteners.

2.5 LOCKING DEVICES

- A. Safety Interlock Switch: Equip power-operated grilles with safety interlock switch to disengage power supply when grille is locked.

2.6 COUNTERBALANCING MECHANISM

- A. General: Counterbalance grilles by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of parts and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.

- C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
- D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.7 ELECTRIC GRILLE OPERATORS

- A. General: Electric grille operator assembly of size and capacity recommended and provided by grille manufacturer for grille and operation cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking grille, and accessories required for proper operation.
 - 1. Comply with NFPA 70.
 - 2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V ac or dc.
- B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each grille.
- C. Grille Operator Location(s): Operator location indicated for each grille.
 - 1. Front-of-Hood Mounted: Operator is mounted to the right or left grille head plate, with the operator on coil side of the grille-hood assembly and connected to the grille drive shaft with drive chain and sprockets. Front clearance is required for this type of mounting.
- D. Motors: Reversible-type motor with controller (disconnect switch) for motor exposure indicated.
 - 1. Electrical Characteristics:
 - a. Phase: Single phase.
 - b. Volts: 115 V.
 - c. Hertz: 60.
 - 2. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate grille in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
 - 3. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
 - 4. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.
- E. Limit Switches: Equip motorized grille with adjustable switches interlocked with motor controls and set to automatically stop grille at fully opened and fully closed positions.
- F. Control Station: Three-button control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure push-button control labeled "Close."

1. Interior-Mounted Units: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
- G. Emergency Manual Operation: Equip electrically powered grille with capability for emergency manual operation. Design manual mechanism so required force for grille operation does not exceed 25 lbf.
- H. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
- I. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.
- J. Emergency-Egress Release: Flush, wall-mounted handle mechanism, for accessibility-code-compliant egress feature, not dependent on electric power. The release allows an unlocked grille to partially open without affecting limit switches to permit passage, and it automatically resets motor drive upon return of handle to original position.

2.8 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" 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.

2.9 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

2.10 STEEL AND GALVANIZED-STEEL FINISHES

- A. Factory Prime Finish: Manufacturer's standard primer, compatible with field-applied finish. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install overhead coiling grilles and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports, according to manufacturer's written instructions and as specified.
- B. Install overhead coiling grilles, hoods, controls, and operators at the mounting locations indicated for each grille.
- C. Accessibility: Install overhead coiling grilles, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.
- D. Power-Operated Grilles: Install according to UL 325.

3.3 STARTUP SERVICE

- A. Perform installation and startup checks according to manufacturer's written instructions.
- B. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.
- C. Test grille opening when activated by detector, fire-alarm system, emergency-egress release, or self-opening mechanism as required. Reset grille-opening mechanism after successful test.

3.4 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly, so that grilles operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.

3.5 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of coiling-grille Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for grille operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 - 1. Perform maintenance, including emergency callback service, during normal working hours.
 - 2. Include 24-hour-per-day, 7-day-per-week, emergency callback service.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling grilles.

END OF SECTION 083326

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Exterior storefront framing.
 - 2. Storefront framing for punched openings.
 - 3. Exterior manual-swing entrance doors.
- B. Related Requirements:
 - 1. Section 084413 "Glazed Aluminum Curtain Walls" for systems without aluminum support framing.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Sustainable Design Submittals:
 - 1. Product Data: For glazing sealants used inside the weatherproofing system, documentation including printed statement of VOC content.
- C. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.
 - 1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
 - 2. Include full-size isometric details of each vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.

- c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.
 - 3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
 - D. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.
 - E. Qualification Data: For Installer.
 - F. Energy Performance Certificates: For aluminum-framed entrances and storefronts, accessories, and components, from manufacturer.
 - 1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront.
 - G. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by a qualified testing agency.
 - H. Field quality-control reports.
 - I. Sample Warranties: For special warranties.
 - J. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.
- 1.5 QUALITY ASSURANCE
- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
 - B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing.
- 1.6 WARRANTY
- A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration created by wind and thermal and structural movements.
 - c. Deterioration of metals and other materials beyond normal weathering.
 - d. Water penetration through fixed glazing and framing areas.
 - e. Failure of operating components.
 - 2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 - 1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 - 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
 - e. Failure of operating units.
- B. Structural Loads:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: As indicated on Drawings.
- C. Deflection of Framing Members: At design wind pressure, as follows:
 - 1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding 1/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
 - 2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller.
 - a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.
- D. Structural: Test according to ASTM E 330 as follows:
 - 1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
 - 2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
 - 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- E. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:
 - 1. Fixed Framing and Glass Area:
 - a. Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft.

2. Entrance Doors:

- a. Pair of Doors: Maximum air leakage of 0.5 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.

F. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 10 lbf/sq. ft.

G. Energy Performance: Certify and label energy performance according to NFRC as follows:

1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.46 Btu/sq. ft. x h x deg F as determined according to NFRC 100. For entrance doors, not more than 0.52 Btu/sq. ft. x h x deg F.
2. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than 60 as determined according to NFRC 500. For entrance doors, minimum rating of 58.

H. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 MANUFACTURERS

A. Basis-of-Design Products: The following products manufactured by YKK AP America:

1. YES 45 FT framing system.
2. MegaTherm 35XT entrance doors.

B. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.

2.3 FRAMING

A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Thermally broken.
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: Front.
4. Finish: Clear anodic finish.
5. Fabrication Method: Field-fabricated stick system.

B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- D. Materials:
 - 1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - a. Sheet and Plate: ASTM B 209.
 - b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
 - c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
 - d. Structural Profiles: ASTM B 308/B 308M.
 - 2. 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.
 - a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
 - b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
 - c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.4 ENTRANCE DOOR SYSTEMS

- A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation. Thermally broken design.
 - 1. Door Construction: 2-3/8-inch overall thickness, with minimum 0.125-inch thick, 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.
 - a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.
 - 2. Door Design: Narrow stile; 3-1/2-inch.
 - 3. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.
 - a. Provide nonremovable glazing stops on outside of door.

2.5 ENTRANCE DOOR HARDWARE

- A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 "Door Hardware."
- B. General: Provide entrance door hardware indicated in "Entrance Door Hardware Sets" Article for each entrance door to comply with requirements in this Section.

1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and as selected from manufacturer's standard offerings.
2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
3. Opening-Force Requirements:
 - a. Egress Doors: Not more than 15 lbf to release the latch and not more than 30 lbf to set the door in motion and not more than 15 lbf to open the door to its minimum required width.
- C. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.
- D. Weather Stripping: Manufacturer's standard replaceable components.
 1. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.
 2. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.
- E. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.
- F. Thresholds: BHMA A156.21, raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch. Manufacturer's standard thermal break design.

2.6 GLAZING

- A. Glazing: Comply with Section 088000 "Glazing."
- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.
- C. Glazing Sealants: As recommended by manufacturer.
- D. Sealants used inside the weatherproofing system shall have a VOC content of 250 g/L.

2.7 ACCESSORIES

- A. 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.
- B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
 1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

- C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- D. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.8 FABRICATION

- A. Form or extruded aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. 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. Physical and thermal isolation of glazing from framing members.
 - 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.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- E. Storefront Framing: Fabricate components for assembly using screw-spline system.
- F. 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.
 - 2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.
- G. 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.
- H. 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.
- I. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.9 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

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. 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 and to prevent impeding movement of moving joints.
 - 6. Seal perimeter and other joints watertight unless otherwise indicated.
- B. Metal Protection:
 - 1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
 - 2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 "Joint Sealants" to produce weathertight installation.
- D. Install components plumb and true in alignment with established lines and grades.
- E. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.
- F. Install glazing as specified in Section 088000 "Glazing."
- G. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.
 - 1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
 - 2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.3 ERECTION TOLERANCES

- A. Erection Tolerances: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:
 - 1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
 - 2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
 - 3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
 - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
 - 4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Field Quality-Control Testing: Perform the following test on representative areas of aluminum-framed entrances and storefronts.
 - 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.
 - a. Perform a minimum of two tests in areas as directed by Architect.
 - b. Perform tests in each test area as directed by Architect.
- C. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.5 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.
 - 2. Initial Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of entrance door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper entrance door hardware operation at rated speed and capacity. Use parts and supplies that are the same as those used in the manufacture and installation of original equipment.

END OF SECTION 084113

SECTION 084126 - ALL-GLASS ENTRANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior sliding all-glass entrance doors and glass sidelites.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for all-glass system.

B. Shop Drawings: For all-glass entrances and storefronts.

1. Include plans, elevations, and sections.
2. Include details of fittings and glazing.
3. Door hardware locations, mounting heights, and installation requirements.

C. Samples for Verification: For each type of exposed finish indicated, prepared on Samples of size indicated below.

1. Metal Finishes: 6-inch-long sections of accessory fittings and other items.
2. Door Hardware: For exposed door hardware of each type, in specified finish, full size.

D. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

E. Qualification Data: For Installer.

F. Sample Warranty: For special warranty.

G. Maintenance Data: For all-glass systems to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

1.5 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of all-glass systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including excessive deflection.
 - b. Deterioration of metals, metal finishes, and other materials.
 - c. Failure of operating components.
 - 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design Manufacturer: DIRT.

2.2 METAL COMPONENTS

- A. Fitting Configuration:
 - 1. Manual-Sliding, All-Glass Entrance Doors: Continuous rail fitting at top and bottom.
 - 2. Glass Sidelites: Top glazing channel and bottom sill leveler assembly. Configurations as indicated on Drawings.
- B. Rail Fittings:
 - 1. Material: Aluminum.
 - 2. Configuration and Height: As indicated on Drawings.
- C. Glazing Frames: Manufacturer's standard aluminum frames for glazing thickness indicated.
- D. Anchors and Fastenings: Concealed.
- E. Materials:
 - 1. Aluminum: ASTM B 221, with strength and durability characteristics of not less than Alloy 6063-T5.

2.3 GLASS

- A. Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated surfaces), Type I (transparent), tested for surface and edge compression per ASTM C 1048 and for impact strength per 16 CFR 1201 for Category II materials.
 - 1. Class 1: Clear monolithic.
 - a. Thickness: As indicated on Drawings.

2. Exposed Edges: Machine ground and flat polished.

2.4 ENTRANCE DOOR HARDWARE

- A. Manual-Sliding Entrance Door Hardware: Manufacturer's standard for sliding action indicated and with multiple rollers.
 1. Type: Top-hung.
- B. Pulls: As indicated on Drawings.

2.5 FABRICATION

- A. Provide holes and cutouts in glass to receive hardware, fittings, and accessory fittings before tempering glass. Do not cut, drill, or make other alterations to glass after tempering.
- B. Factory assemble components and factory install hardware and fittings to greatest extent possible.

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. Install all-glass systems and associated components according to manufacturer's written instructions.
- B. Set units level, plumb, and true to line, with uniform joints.
- C. Maintain uniform clearances between adjacent components.
- D. Lubricate hardware and other moving parts according to manufacturer's written instructions.
- E. Set, seal, and grout floor closer cases as required to suit hardware and substrate indicated.

3.3 ADJUSTING AND CLEANING

- A. Adjust all-glass entrance doors and hardware to produce smooth operation.

END OF SECTION 084126

SECTION 084413 - GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes glazed aluminum curtain walls.
- B. Related Requirements:
 - 1. Section 084113 "Aluminum-Framed Entrances and Storefronts" for entrance doors as a component of glazed aluminum curtain wall assemblies.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site

1.4 SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Sustainable Design Submittals:
 - 1. Product Data: For glazing sealants used inside the weatherproofing system, documentation including printed statement of VOC content.
- C. Shop Drawings: For glazed aluminum curtain walls. Include plans, elevations, sections, full-size details, and attachments to other work.
 - 1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
 - 2. Include full-size isometric details of each vertical-to-horizontal intersection of glazed aluminum curtain walls, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.

3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
- D. Qualification Data: For Installer.
- E. Energy Performance Certificates: For glazed aluminum curtain walls, accessories, and components from manufacturer.
 1. Basis for Certification: NFRC-certified energy performance values for each glazed aluminum curtain wall.
- F. Product Test Reports: For glazed aluminum curtain walls, for tests performed by a qualified testing agency.
- G. Field quality-control reports.
- H. Sample Warranties: For special warranties.
- I. Maintenance Data: For glazed aluminum curtain walls to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025.

1.6 WARRANTY

- A. Special Assembly Warranty: Manufacturer agrees to repair or replace components of glazed aluminum curtain wall that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration created by wind and thermal and structural movements.
 - c. Deterioration of metals and other materials beyond normal weathering.
 - d. Water penetration through fixed glazing and framing areas.
 2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Comply with performance requirements specified, as determined by testing of glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Glazed aluminum curtain walls shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
 - e. Failure of operating units.
- B. Structural Loads:
1. Wind Loads: As indicated on Drawings.
 2. Other Design Loads: As indicated on Drawings.
- C. Deflection of Framing Members: At design wind pressure, as follows:
1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding 1/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
 2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller.
- D. Structural: Test according to ASTM E 330 as follows:
1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
 2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- E. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:
1. Fixed Framing and Glass Area:
 - a. Maximum air leakage of 0.01 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft.
- F. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:
1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 12 lbf/sq. ft.
- G. Energy Performance: Certify and label energy performance according to NFRC as follows:
1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.43 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
 2. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than 71 as determined according to NFRC 500.

- H. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 MANUFACTURERS

- A. Basis-of-Design Product: YKK AP America; YCW 700.
- B. Source Limitations: Obtain all components of curtain wall system, including framing, sun control, and accessories, from single manufacturer.

2.3 FRAMING

- A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
1. Construction: Thermally broken.
 2. Glazing System: Retained mechanically with gaskets on four sides.
 3. Glazing Plane: Front.
 4. Finish: Clear anodic finish.
 5. Fabrication Method: Field-fabricated stick system.
- B. Pressure Caps: Manufacturer's standard aluminum components that mechanically retain glazing.
1. Include snap-on aluminum trim that conceals fasteners.
- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- D. Materials:
1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - a. Sheet and Plate: ASTM B 209.
 - b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
 - c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
 - d. Structural Profiles: ASTM B 308/B 308M.
 2. 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.
 - a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
 - b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
 - c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.4 ENTRANCES

- A. Entrances: Comply with Section 084113 "Aluminum-Framed Entrances and Storefronts."

2.5 SUN CONTROL

- A. Basis of Design, Sunshades: YKK AP America; ThermaShade.
 - 1. Description: Clear anodized finish aluminum members consisting of outriggers with integral airfoil profile louvers. Thermally broken anchorage system for attachment to curtain wall framing.
 - 2. Orientation: Horizontal.
 - 3. Projection from Wall: As indicated on Drawings

2.6 GLAZING

- A. Glazing: Comply with Section 088000 "Glazing."
- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.
- C. Glazing Sealants: As recommended by manufacturer.

2.7 ACCESSORIES

- A. 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.
- B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
 - 1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.
- C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- D. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.8 FABRICATION

- A. Form or extrude aluminum shapes before finishing.

- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. 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. Physical and thermal isolation of glazing from framing members.
 - 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.
- D. Fabricate components to resist water penetration as follows:
 - 1. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
- E. Curtain-Wall Framing: Fabricate components for assembly using shear-block system.
- F. Factory-Assembled Frame Units:
 - 1. Rigidly secure nonmovement joints.
 - 2. Preparation includes, but is not limited to, cleaning and priming surfaces.
 - 3. Seal joints watertight unless otherwise indicated.
 - 4. Install glazing to comply with requirements in Section 088000 "Glazing."
- G. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.9 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

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. 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 and to prevent impeding movement of moving joints.
6. Where welding is required, weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
7. Seal joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum is in contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.

D. Install components plumb and true in alignment with established lines and grades.

E. Install glazing as specified in Section 088000 "Glazing."

3.3 ERECTION TOLERANCES

A. Erection Tolerances: Install glazed aluminum curtain walls to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
 - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Test Area: Perform tests on representative areas of glazed aluminum curtain walls.

C. Field Quality-Control Testing: Perform the following test on representative areas of glazed aluminum curtain walls.

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.
 - a. Perform a minimum of two tests in areas as directed by Architect.
 - b. Perform tests in each test area as directed by Architect.
- D. Glazed aluminum curtain walls will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

END OF SECTION 084413

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes door hardware for swinging doors.
- B. Refer to Drawings for door hardware schedule, including basis of design for individual hardware products.
- C. Related Requirements:
 - 1. Section 081113 "Hollow Metal Doors and Frames".
 - 2. Section 081416 "Flush Wood Doors"
 - 3. Section 084113 "Aluminum-Framed Entrances and Storefronts".

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Other Action Submittals:
 - 1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - a. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
 - b. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
 - c. Content: Include the following information:
 - 1) Identification number, location, hand, fire rating, size, and material of each door and frame.
 - 2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
 - 3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
 - 4) Fastenings and other pertinent information.
 - 5) Explanation of abbreviations, symbols, and codes contained in schedule.
 - 6) Mounting locations for door hardware.
 - 7) List of related door devices specified in other Sections for each door and frame.

- 2. Keying Schedule: Prepared by or under the supervision of Installer, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.
- C. Qualification Data: For Installer and Architectural Hardware Consultant.
- D. Warranty: Special warranty specified in this Section.
- E. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware schedule.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
 - 1. Warehousing Facilities: In Project's vicinity.
 - 2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
- B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as follows:
 - 1. For door hardware, an Architectural Hardware Consultant (AHC).
- C. Source Limitations: Obtain each type of door hardware from a single manufacturer.
- D. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.
- E. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.
 - 1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
 - 2. Comply with the following maximum opening-force requirements:
 - a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
 - 3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
 - 4. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.
- F. Preinstallation Conference: Conduct conference at Project site.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

1.5 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including excessive deflection, cracking, or breakage.
 - b. Faulty operation of doors and door hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
 - 2. Warranty Period: Three years from date of Substantial Completion, unless otherwise indicated.
 - a. Manual Closers: 10 years from date of Substantial Completion.

1.7 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
- B. Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door and door hardware operation. Provide parts and supplies that are the same as those used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. Provide door hardware for each door as scheduled on Drawings to comply with requirements in this Section.

2.2 HINGES

- A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.
 - 1. Manufacturers: Provide products by one of the following:
 - a. Hager Companies.
 - b. IVES Hardware.
 - c. McKinney Products Company.
 - d. Stanley Commercial Hardware.

2.3 MECHANICAL LOCKS AND LATCHES

- A. Lock Functions: As indicated in door hardware schedule.
- B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
 - 1. Bored Locks: Minimum 1/2-inch latchbolt throw.
 - 2. Deadbolts: Minimum 1-inch bolt throw.
- C. Lock Backset: 2-3/4 inches, unless otherwise indicated.
- D. Lock Trim:
 - 1. Operating Device: Lever with escutcheons (roses).
- E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.
 - 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
- F. Bored Locks: BHMA A156.2; Grade 1; Series 4000.
 - 1. Manufacturers: Provide products by one of the following:
 - a. Best Access Systems.
 - b. Corbin Russwin Architectural Hardware.
 - c. SARGENT Manufacturing Company.
 - d. Schlage Commercial Lock.

2.4 ELECTRIC STRIKES

- A. Electric Strikes: BHMA A156.31; Grade 1; with faceplate to suit lock and frame.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Adams Rite Manufacturing Co; an ASSA ABLOY Group company.
 - b. Hager Companies.
 - c. HES, Inc.; an ASSA ABLOY Group company.
 - d. Security Door Controls.

2.5 SELF-CONTAINED ELECTRONIC LOCKS

- A. Self-Contained Electronic Locks: BHMA A156.25, bored; with internal, battery-powered, self-contained electronic locks; consisting of complete lockset, motor-driven lock mechanism, and actuating device; enclosed in zinc-dichromate-plated, wrought-steel case, and strike that suits frame. Provide key override, low-battery detection and warning, LED status indicators, and ability to program at the lock.

1. Manufacturers: Provide products by one of the following:
 - a. Best Access Systems.
 - b. Kaba Ilco Corp.
 - c. SARGENT Manufacturing Company.
 - d. Schlage Commercial Lock.

2.6 EXIT LOCKS AND EXIT ALARMS

- A. Exit Locks and Alarms: BHMA A156.29, Grade 1.

1. Manufacturers: Provide products by one of the following:
 - a. Arrow USA.
 - b. Detex Corporation.
 - c. SARGENT Manufacturing Company.

2.7 EXIT DEVICES AND AUXILIARY ITEMS

- A. Exit Devices and Auxiliary Items: BHMA A156.3.

1. Products: As scheduled on Drawings.

2.8 LOCK CYLINDERS

- A. Lock Cylinders: Furnished by Owner for installation by Contractor.

1. Basis-of-Design Manufacturer: Medeco Security Locks, Inc.

- B. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

2.9 KEYING

- A. Keying System: As determined by Owner.

2.10 SURFACE CLOSERS

- A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

- 1. Manufacturers: Provide products by one of the following:
 - a. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
 - b. DORMA Architectural Hardware.
 - c. LCN Closers.
 - d. SARGENT Manufacturing Company.

2.11 MECHANICAL STOPS AND HOLDERS

- A. Wall- and Floor-Mounted Stops: BHMA A156.16.

- 1. Manufacturers: Provide products by one of the following:
 - a. Burns Manufacturing Incorporated.
 - b. Hager Companies.
 - c. IVES Hardware.
 - d. Rockwood Manufacturing Company.
 - e. Stanley Commercial Hardware.
 - f. Trimco.

2.12 OVERHEAD STOPS AND HOLDERS

- A. Overhead Stops and Holders: BHMA A156.8.

- 1. Manufacturers: Provide products by one of the following:
 - a. Glynn-Johnson.
 - b. Rockwood Manufacturing Company.
 - c. SARGENT Manufacturing Company.

2.13 DOOR GASKETING

- A. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 cfm per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

1. Manufacturers: Provide products by one of the following:

- a. Hager Companies.
- b. National Guard Products.
- c. Pemko Manufacturing Co..
- d. Zero International.

2.14 THRESHOLDS

- A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.

1. Manufacturers: Provide products by one of the following:

- a. Hager Companies.
- b. National Guard Products.
- c. Pemko Manufacturing Co.
- d. Zero International.

2.15 METAL PROTECTIVE TRIM UNITS

- A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch thick stainless steel; with manufacturer's standard machine or self-tapping screw fasteners.

1. Manufacturers: Provide products by one of the following:

- a. Burns Manufacturing Incorporated.
- b. IVES Hardware; an Ingersoll-Rand company.
- c. Rockwood Manufacturing Company.
- d. Trimco.

2.16 FABRICATION

- A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

- B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.

- C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
3. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
4. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.17 FINISHES

- A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
- B. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."

3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.
 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing. Do not install surface-mounted items until finishes have been completed on substrates involved.
 - 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 - 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- C. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- D. Lock Cylinders: Install construction cores to secure building and areas during construction period.
 - 1. Replace construction cores with permanent cores as directed by Owner.
- E. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."
- F. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.
- G. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- H. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
 - 1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

3.5 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

END OF SECTION 087100

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
 - 1. Glazed curtain walls.
 - 2. Storefront framing.
 - 3. Glazed entrances.
- B. Related Requirements:
 - 1. Section 084113 "Aluminum-Framed Entrances and Storefronts."
 - 2. Section 084413 "Glazed Aluminum Curtain Walls"

1.2 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) 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. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

1.3 SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- C. Qualification Data: For installer.
- D. Product Certificates: For glass and glazing products, from manufacturer.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for insulating glass.
- F. Warranties: Sample of special warranties.

1.4 QUALITY ASSURANCE

- A. 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.
- B. Source Limitations for Glass: Obtain insulating glass from single source from single manufacturer for each glass type.
- C. 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 "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."
- D. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- E. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
- F. Preinstallation Conference: Conduct conference at Project site.
 - 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.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. 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.
- B. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.6 PROJECT 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.

1.7 WARRANTY

- A. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which 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: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

- A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.
 1. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.
- B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.
- C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
 1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick.
 2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 3. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
 4. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
 5. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 GLASS PRODUCTS

- A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.
- B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.
 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
 2. For uncoated glass, comply with requirements for Condition A.
 3. For coated vision glass, comply with requirements for Condition C (other coated glass).

2.3 INSULATING GLASS

- A. Basis of Design Manufacturer: Vitro Architectural Glass. Other acceptable manufacturers:
 1. AGC Glass Company North America, Inc.
 2. Pilkington (Nippon Sheet Glass Co., Ltd.)
 3. Oldcastle BuildingEnvelope.
 4. Viracon.

- B. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.
 - 1. Sealing System: Dual seal, with manufacturer's standard primary and secondary.
 - 2. Spacer: Aluminum with mill or clear anodic finish.
 - 3. Desiccant: Molecular sieve or silica gel, or blend of both.
- C. Glass: Comply with applicable requirements in "Glass Products" Article.

2.4 GLAZING GASKETS

- A. Glazing gaskets are specified in Sections 084113 and 084413.

2.5 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining 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 C 1281 and AAMA 800.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800.

2.6 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 for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions of 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).

2.7 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

2.8 MONOLITHIC-GLASS TYPES

A. Glass Type: Clear float glass, fully tempered.

1. Thickness: 6.0 mm.
2. Provide safety glazing labeling.

2.9 INSULATING-GLASS TYPES

A. Glass Type: Low-e-coated, clear insulating glass.

1. Basis of Design: PPG Industries, Inc.; Solarban 60 (2) Clear + Clear.
2. Overall Unit Thickness: 1 inch.
3. Thickness of Each Glass Lite: 6.0 mm.
4. Outdoor Lite: Fully tempered float glass.
5. Interspace Content: Argon.
6. Indoor Lite: Fully tempered float glass.
7. Low-E Coating: Sputtered on second surface.
8. Visible Light Transmittance: 70 percent minimum.
9. Winter Nighttime U-Factor: 0.29 maximum.
10. Summer Daytime U-Factor: 0.27 maximum.
11. Solar Heat Gain Coefficient: 0.39 maximum.
12. Provide safety glazing labeling.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 2. Presence and functioning of weep systems.
 3. Minimum required face and edge clearances.
 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, with reasonable tolerances.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, 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 lites where length plus width is larger than 50 inches.
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch minimum bite of spacers on glass. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.

- F. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Install gaskets so they protrude past face of glazing stops.

3.6 CLEANING AND PROTECTION

- A. Protect exterior glass from damage 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. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing 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 buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

END OF SECTION 088000

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
2. Suspension systems for interior gypsum ceilings, soffits, and grid systems.

B. Related Requirements:

1. Section 054000 "Cold-Formed Metal Framing" for exterior wall studs.

1.2 SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- ##### A. STC-Rated Assemblies:
- For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 FRAMING SYSTEMS

- ##### A. Recycled Content of Steel Products:
- Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- ##### B. Framing Members, General:
- Comply with ASTM C 754 for conditions indicated.
1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
 2. Protective Coating: ASTM A 653/A 653M, G60, hot-dip galvanized unless otherwise indicated.

- C. Studs and Runners: ASTM C 645.
 - 1. Steel Studs and Runners:
 - a. Minimum Base-Metal Thickness: As indicated on Drawings.
 - b. Depth: As indicated on Drawings.
- D. Slip-Type Head Joints: Where indicated, provide one of the following:
 - 1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
 - 2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
- E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
 - 1. Minimum Base-Metal Thickness: 0.033 inch.

2.3 SUSPENSION SYSTEMS

- A. 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.
- B. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.
- C. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock; unless otherwise indicated.
 - 1. Products: Provide one of the following:
 - a. Armstrong World Industries, Inc.; Drywall Grid Systems.
 - b. Chicago Metallic Corporation; Drywall Grid System.
 - c. USG Corporation; Drywall Suspension System.

2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
 - 1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide one of the following:
 - 1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
 - 2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

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.

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.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
 - 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, 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.

3.4 INSTALLING FRAMED ASSEMBLIES

- A. 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. Multilayer Application: 16 inches o.c. unless otherwise indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. 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 penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 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. Extend jamb studs through suspended ceilings and attach to underside of overhead structure, where indicated.
 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.
 4. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- E. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.5 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
1. Hangers: 48 inches o.c.
 2. Carrying Channels (Main Runners): 48 inches o.c.
 3. Furring Channels (Furring Members): 16 inches o.c.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
1. 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.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 2. 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.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
 3. 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.
 4. Do not attach hangers to steel roof deck.
 5. Do not connect or suspend steel framing from ducts, pipes, or conduit.

- D. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- E. Installation 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.

END OF SECTION 092216

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Exterior gypsum board.
3. Security mesh.

B. Related Requirements:

- 1.
2. Section 092216 "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board panels.

1.2 SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
2. Product Certificates: For products and materials required to comply with requirements for regional materials, certificates indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating distance to Project, cost for each regional material, and fraction by weight that is considered regional.

1.3 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.4 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are 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.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

- A. Recycled Content of Gypsum Panel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Regional Materials: Gypsum panel products shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- C. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

- A. Manufacturers: Provide products by one of the following:
 1. CertainTeed Corp.
 2. Georgia-Pacific Gypsum LLC.
 3. National Gypsum Company.
 4. USG Corporation.
- B. Gypsum Board, Type X: ASTM C 1396/C 1396M.
 1. Thickness: 5/8 inch.
 2. Long Edges: Tapered.
- C. Gypsum Ceiling Board: ASTM C 1396/C 1396M.
 1. Thickness: 1/2 inch.
 2. Long Edges: Tapered.
- D. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.
 1. Core: 5/8 inch, Type X].
 2. Long Edges: Tapered.
 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.4 EXTERIOR GYPSUM BOARD FOR CEILINGS AND SOFFITS

- A. Exterior Gypsum Soffit Board: ASTM C 1396/C 1396M, with manufacturer's standard edges.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation.
 - b. Georgia-Pacific Gypsum LLC.
 - c. National Gypsum Company.
 - d. USG Corporation.
 - 2. Core: 5/8 inch, Type X.

2.5 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
 - 1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
 - 2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. L-Bead: L-shaped; exposed long flange receives joint compound.
 - d. U-Bead: J-shaped; exposed short flange does not receive joint compound.
- B. Exterior Trim: ASTM C 1047.
 - 1. Material: Hot-dip galvanized-steel sheet, plastic, or rolled zinc.
 - 2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

2.6 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
 - 1. Interior Gypsum Board: Paper.
 - 2. Exterior Gypsum Soffit Board: Paper.

- C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
 - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
 - 3. Fill Coat: For second coat, use drying-type, all-purpose compound.
 - 4. Finish Coat: For third coat, use drying-type, all-purpose compound.
 - 5. Skim Coat: For final coat of Level 5 finish, use high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.
- D. Joint Compound for Exterior Applications:
 - 1. Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sandable topping compound.

2.7 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
- C. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - 1. Recycled Content of Blankets: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 20 percent.
- D. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 - 1. Products: Provide one of the following:
 - a. Accumetric LLC; BOSS 824 Acoustical Sound Sealant.
 - b. Grabber Construction Products; Acoustical Sealant GSC.
 - c. Pecora Corporation; AC-20 FTR.
 - d. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
 - e. USG Corporation; SHEETROCK Acoustical Sealant.
 - 2. Acoustical joint sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

- F. Security Mesh: Steel expanded diamond mesh panels; ASTM A 569, ASTM F 1267, Type II, Class 1.
 - 1. Basis of Design, Mesh: Alabama Metal Industries Corporation; Amico Security Mesh ASM .75-9F. Heavy mesh, 63 percent open. Provide 9 gage mesh for walls, in locations indicated on Drawings.
 - 2. Basis of Design, Attachment Clips: Alabama Metal Industries Corporation; Secura Clips.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. 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.
- C. Install panels with face side out. 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.
- 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. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Fit gypsum panels around ducts, pipes, and conduits.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

- I. STC-Rated Assemblies: 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. Comply with ASTM C 919 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.
- J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 - 1. Type X: Vertical surfaces unless otherwise indicated.
 - 2. Ceiling Type: Ceiling surfaces.
 - 3. Moisture- and Mold-Resistant Type: As indicated on Drawings.
- B. Single-Layer Application:
 - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
 - 2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - 3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- C. Multilayer Application:
 - 1. On ceilings, apply gypsum board indicated for base layers before applying face layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated.
 - 2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated. Stagger joints on opposite sides of partitions.
 - 3. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

3.4 APPLYING EXTERIOR GYPSUM PANELS FOR CEILINGS AND SOFFITS

- A. Apply panels perpendicular to supports, with end joints staggered and located over supports.
 - 1. Install with 1/4-inch open space where panels abut other construction or structural penetrations.
 - 2. Fasten with corrosion-resistant screws.

3.5 INSTALLING TRIM ACCESSORIES

- A. General: 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.
- B. Control Joints: Install control joints at locations indicated on Drawings.
- C. Interior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners.
 - 2. LC-Bead: Use at exposed panel edges.
 - 3. L-Bead: Use where indicated.
- D. Exterior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners.
 - 2. LC-Bead: Use at exposed panel edges.

3.6 INSTALLING SECURITY MESH

- A. Install security mesh over plywood wall sheathing on one side of metal wall framing members and secure with specified clips, using manufacturer approved screw fasteners. Screw heads must be flush with clip faces to provide a proper surface to receive gypsum board.
- B. Security mesh panels must be butted. Overlapping of panels is not permissible.

3.7 FINISHING GYPSUM BOARD

- A. General: 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 decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints 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 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated. Primer and its application to surfaces are specified in Section 099100 "Painting."
 - 3. Level 5: Where indicated on Drawings. Primer and its application to surfaces are specified in Section 099100 "Painting."

3.8 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. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 093000 - TILING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section ceramic floor tile and base.
 - 1. Ceramic tile.
- B. Related Requirements:
 - 1. Section 079200 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Sustainable Design Submittals:
 - 1. Product Data: For adhesives, grouts, and sealants, documentation including printed statement of VOC content.
 - 2. Product Data: For tile floors, documentation from an independent testing agency indicating compliance with the FloorScore Standard.
- C. Qualification Data: For qualified Installer.
- D. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- E. Furnish 10 percent attic of tiling materials.

1.3 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.
- E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.4 PROJECT CONDITIONS

- A. 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.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
 - 1. Provide tile complying with Standard grade requirements.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCA installation methods specified in tile installation schedules, and other requirements specified.
- C. FloorScore Compliance: Tile for floors shall comply with requirements of FloorScore Standard.
- D. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- E. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

2.2 TILE PRODUCTS

- A. Tile Type: Ceramic floor tile.
 - 1. Basis-of-Design Product: As indicated or scheduled on Drawings.
 - 2. Grout Color: As indicated on Drawings.
 - 3. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide base cove shapes.

2.3 SETTING MATERIALS

- A. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.
 - 1. Manufacturers: Provide products by one of the following:
 - a. Bonsal American; an Oldcastle company.
 - b. Bostik, Inc.
 - c. Custom Building Products.
 - d. Jamo Inc.
 - e. Laticrete International, Inc.
 - f. MAPEI Corporation.

2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.

2.4 GROUT MATERIALS

A. Polymer-Modified Tile Grout: ANSI A118.7.

1. Manufacturers: Provide products by one of the following:
 - a. Bonsal American; an Oldcastle company.
 - b. Bostik, Inc.
 - c. Custom Building Products.
 - d. Jamo Inc.
 - e. Laticrete International, Inc.
 - f. MAPEI Corporation.
2. Polymer Type: Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.

B. Water-Cleanable Epoxy Grout: ANSI A118.3, with a VOC content of 65 g/L or less.

1. Manufacturers: Provide products by one of the following:
 - a. Bonsal American; an Oldcastle company.
 - b. Bostik, Inc.
 - c. Custom Building Products.
 - d. Jamo Inc.
 - e. Laticrete International, Inc.
 - f. MAPEI Corporation.
2. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F, respectively, and certified by manufacturer for intended use.

2.5 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- C. Grout Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.
- D. Floor Transition Trim Elements: As indicated on Drawings.

2.6 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' 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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
 - 1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
 - 2. Verify that concrete substrates for tile floors installed with thin-set mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
 - a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
 - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
 - 3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with adhesives with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 TILE INSTALLATION

- A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series

"Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
- E. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
 - 1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
 - 2. Where adjoining tiles on floor and base are specified or indicated to be same size, align joints.
- F. Joint Widths: Unless otherwise indicated, install tile with 1/4 inch joint widths.
- G. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
 - 1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
- H. Grout Sealer: Apply grout sealer to grout joints in tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 CLEANING AND PROTECTING

- A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 - 1. Remove latex-portland cement grout residue from tile as soon as possible.
 - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
- B. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

- C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.5 INTERIOR TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:

- 1. Tile Installation F113: Thin-set mortar; TCA F113.
 - a. Thin-Set Mortar: Latex-portland cement mortar.
 - b. Grout: Polymer-modified sanded grout or epoxy grout, as scheduled.

END OF SECTION 093000

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes acoustical panels and exposed suspension systems for ceilings.

1.2 SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. Product Data: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.
 - 2. Product Data: For sealants, documentation including printed statement of VOC content.
- C. Maintenance Data: For finishes to include in maintenance manuals.
- D. Furnish 10 percent attic stock of acoustical panel ceiling materials.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.4 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
 - 2. Smoke-Developed Index: 50 or less.

2.2 ACOUSTICAL PANELS, GENERAL

- A. Source Limitations:
 - 1. Acoustical Ceiling Panel: Obtain each type from single source from single manufacturer.
 - 2. Suspension System: Obtain each type from single source from single manufacturer.
- B. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system from single source from single manufacturer.
- C. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- D. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.
 - 1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface according to ASTM E 795.
- E. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

2.3 ACOUSTICAL PANELS

- A. Basis-of-Design Product: Armstrong World Industries, Inc.; Cortega Second Look.
- B. Color: White.
- C. LR: Not less than 0.82.
- D. NRC: Not less than 0.55.
- E. CAC: Not less than 35.
- F. Edge/Joint Detail: Square.
- G. Thickness: 3/4 inch.
- H. Modular Size: 24 by 24 inches.

- I. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.4 METAL SUSPENSION SYSTEMS, GENERAL

- A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.
- C. 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.
- D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
 - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - 2. Size: Select wire diameter so 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 provide not less than 0.106-inch diameter wire.

2.5 METAL SUSPENSION SYSTEM

- A. Basis-of-Design Product: Armstrong World Industries, Inc.; Prelude XL.
- B. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 coating designation; with prefinished 15/16-inch wide metal caps on flanges.
 - 1. Structural Classification: Intermediate-duty system.
 - 2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
 - 3. Face Design: Flat, flush.
 - 4. Cap Material: Steel or aluminum cold-rolled sheet.
 - 5. Cap Finish: Painted white.

2.6 METAL EDGE MOLDINGS AND TRIM

- A. Basis-of-Design Manufacturer: Armstrong World Industries, Inc.
- B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.
2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

2.7 ACOUSTICAL SEALANT

- A. Acoustical Sealant for Exposed and Concealed Joints: Provide one of the following:
 1. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
 2. USG Corporation; SHEETROCK Acoustical Sealant.
- B. 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.
 1. Exposed and Concealed Joints: Nonsag, paintable, nonstaining latex sealant.
 2. Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant.
 3. Acoustical sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

- B. Suspend ceiling hangers from building's structural members and as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 5. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 6. Do not attach hangers to steel deck tabs.
 7. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 8. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
 9. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to steel deck or steel deck tabs.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.

3.4 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Resilient base.
 - 2. Resilient molding accessories.

1.2 SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. Product Data: For adhesives, indicating VOC content.
 - 2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
 - 3. Product Data: For sealants, indicating VOC content.
 - 4. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.
 - 5. Laboratory Test Reports: For resilient base and stair products and accessories, indicating compliance with requirements for low-emitting materials.
 - 6. Environmental Product Declaration: For each product.
 - 7. Health Product Declaration: For each product.
 - 8. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.
 - 9. Product Data: For adhesives, documentation including printed statement of VOC content.
- C. Furnish 10 percent attic stock of resilient base and accessory materials.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.4 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.

- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Products shall comply with the 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."

2.2 VINYL BASE

- A. Manufacturers: Provide products by one of the following:
 - 1. Armstrong World Industries, Inc.
 - 2. Burke Mercer Flooring Products.
 - 3. Flexco.
 - 4. Johnsonite.
 - 5. Roppe Corporation, USA.
- B. Product Standard: ASTM F 1861, Type TV (vinyl, thermoplastic).
 - 1. Group: I (solid, homogeneous).
 - 2. Style and Location:
 - a. Style A, Straight: Provide in areas with carpet.
 - b. Style B, Cove: Provide in areas with resilient flooring.
- C. Minimum Thickness: 0.125 inch.
- D. Height: 4 inches.
- E. Lengths: Coils in manufacturer's standard length.
- F. Outside Corners: Job formed.
- G. Inside Corners: Job formed.
- H. Colors and Patterns: As indicated on Drawings.

2.3 VINYL MOLDING ACCESSORY

- A. Manufacturers: Provide products by one of the following:
 - 1. Armstrong World Industries, Inc.
 - 2. Burke Mercer Flooring Products.
 - 3. Flexco.

4. Johnsonite.
5. Musson Rubber Company.
6. Roppe Corporation, USA.

B. Description: Refer to Drawings for types, profiles, dimensions, and locations.

C. Colors and Patterns: As scheduled on Drawings.

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

1. Adhesives shall have a VOC content of 50 g/L or less.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

1. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
2. Moisture Testing: Proceed with installation only after substrates pass testing according to manufacturer's written recommendations.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until they are the same temperature as the space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. Job-Formed Corners:
 1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length. Form without producing discoloration (whitening) at bends.
 2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length. Miter corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
 1. Remove adhesive and other blemishes from exposed surfaces.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

SECTION 096519 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes vinyl composition floor tile.

1.2 SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. Product Data: For adhesives, indicating VOC content.
 - 2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
 - 3. Product Data: For chemical-bonding compounds, indicating VOC content.
 - 4. Laboratory Test Reports: For chemical-bonding compounds, indicating compliance with requirements for low-emitting materials.
 - 5. Product Data: For sealants, indicating VOC content.
 - 6. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.
 - 7. Laboratory Test Reports: For flooring products, indicating compliance with requirements for low-emitting materials.
 - 8. Environmental Product Declaration: For each product.
 - 9. Health Product Declaration: For each product.
 - 10. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.
- C. Qualification Data: For Installer.
- D. Maintenance Data: For each type of floor tile to include in maintenance manuals.
- E. Furnish 10 percent attic stock for resilient tile flooring materials.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.5 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Close spaces to traffic during floor tile installation.
- D. Close spaces to traffic for 48 hours after floor tile installation.
- E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
- B. Flooring products shall comply with the 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."

2.2 VINYL COMPOSITION FLOOR TILE

- A. Basis of Design: Armstrong World Industries, Inc.; Excelon.
- B. Tile Standard: ASTM F 1066, Class 2, through-pattern tile.
- C. Wearing Surface: Smooth.
- D. Thickness: 0.125 inch.
- E. Size: 12 by 12 inches.
- F. Colors and Patterns: As indicated on Drawings.

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.

- B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.
 - 1. Adhesives shall comply with the following limits for VOC content:
 - a. Vinyl Composition Tile Adhesives: 50 g/L or less.
 - 2. Adhesive 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."
- C. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
 - 4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install floor tiles until they are the same temperature as the space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
1. Lay tiles square with room axis.
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
1. Remove adhesive and other blemishes from exposed surfaces.
 2. Sweep and vacuum surfaces thoroughly.
 3. Damp-mop surfaces to remove marks and soil.
- C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

- D. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish.
- E. Cover floor tile until Substantial Completion.

END OF SECTION 096519

SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes modular carpet tile.
- B. Related Requirements:
 - 1. Section 096513 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.

1.2 SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
 - 2. Include installation recommendations for each type of substrate.
- B. Sustainable Design Submittals:
 - 1. Product Data: For adhesives, indicating VOC content.
 - 2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
 - 3. Laboratory Test Reports: For flooring products, indicating compliance with requirements for low-emitting materials.
- C. Product Schedule: For carpet tile. Use same designations indicated on Drawings.
- D. Qualification Data: For Installer.
- E. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.
- F. Sample Warranty: For special warranty.
- G. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
 - 1. Methods for maintaining carpet tile, 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 tile.
- H. Furnish 10 percent attic stock for tile carpeting materials.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

- B. Fire-Test-Response Ratings: Where indicated, provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI 104.

1.5 FIELD CONDITIONS

- A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.
- B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.
- C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

1.6 WARRANTY

- A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
 - 1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
 - 2. Failures include, but are not limited to, more than 10 percent edge raveling, snags, runs, dimensional stability, excess static discharge, loss of tuft bind strength, loss of face fiber, and delamination.
 - 3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE

- A. Basis-of-Design Product: As scheduled on Drawings.
- B. Color and Pattern: As scheduled on Drawings.
- C. Primary Backing/Backcoating: Manufacturer's standard composite materials.
- D. Secondary Backing: Manufacturer's standard material.
- E. Size: As indicated on Drawings.
- F. Applied Soil-Resistance Treatment: Manufacturer's standard material.
- G. Antimicrobial Treatment: Manufacturer's standard material.

H. Sustainable Design Requirements:

1. Flooring products shall comply with the 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."

I. Performance Characteristics: As follows:

1. Critical Radiant Flux Classification: Not less than 45 W/sq. cm].
2. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria, not less than 1-mm halo of inhibition for gram-negative bacteria, and no fungal growth, according to AATCC 174.
3. Electrostatic Propensity: Less than 3.5 kV according to AATCC 134.
4. Emissions: Provide carpet tile that complies with testing and product requirements of CRI's "Green Label Plus" program.

2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.
1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Adhesive 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."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
 2. Subfloor finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" for slabs receiving carpet tile.
 3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.
- 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 tile manufacturer.
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

- A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.
- B. Installation Method: As recommended in writing by carpet tile manufacturer.
- C. Maintain dye lot integrity. Do not mix dye lots in same area.
- D. Cut and fit carpet tile 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 tile manufacturer.
- E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- 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, nonstaining marking device.
- G. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:
 - 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
 - 2. Remove yarns that protrude from carpet tile surface.
 - 3. Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."

- C. Protect carpet tile 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 tile manufacturer.

END OF SECTION 096813

SECTION 099100 - PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes surface preparation and field painting of the following:
 - 1. Exposed interior items and surfaces.
 - 2. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.
- B. Paint exposed surfaces except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Architect will select from standard colors or finishes available.
 - 1. Painting includes field painting exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.
- C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
 - 1. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual Global (FMG), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.
- D. Related Requirements:
 - 1. Section 081113 "Hollow Metal Doors and Frames" for shop priming steel door and frames.

1.2 SUBMITTALS

- A. Product Data: For each paint system specified. Include block fillers and primers.
 - 1. Material List: Provide an inclusive list of required coating materials. Identify each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
 - 2. Manufacturer's Information: Provide the manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.
- B. Sustainable Design Submittals:
 - 1. Product Data: For paints and coatings, indicating VOC content.
 - 2. Laboratory Test Reports: For paints and coatings, indicating compliance with requirements for low-emitting materials.

- C. Samples for Verification: Of each color and material to be applied, with texture to simulate actual conditions, on representative samples of the actual substrate.
 - 1. Provide stepped samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing samples for review. Resubmit until required sheen, color, and texture are achieved.
 - 2. Provide a list of materials and applications for each coat of each sample. Label each sample for location and application.
- D. Qualification Data: For applicator.

1.3 QUALITY ASSURANCE

- A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a successful in-service performance.
- B. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
 - 1. Product name or title of material.
 - 2. Product description (generic classification or binder type).
 - 3. Manufacturer's stock number and date of manufacture.
 - 4. Contents by volume, for pigment and vehicle constituents.
 - 5. Thinning instructions.
 - 6. Application instructions.
 - 7. Color name and number.
 - 8. VOC content.
- B. Store materials not in use in tightly covered containers in a well ventilated area at a minimum ambient temperature of 45 deg F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.
 - 1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.5 PROJECT CONDITIONS

- A. Apply water-based paints only when temperature of surfaces to be painted and surrounding air temperatures are between 50 and 90 deg F.
- B. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air temperatures are between 45 and 95 deg F.

- C. Do not apply paint in environmental conditions that are not within manufacturer's recommended limitations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Products specified in Paint Schedules at the end of this Section are produced by Benjamin Moore and Co. (Moore). Subject to compliance with requirements, equivalent products by one of the following manufacturers are also acceptable:
 - 1. PPG Industries, Inc.
 - 2. Sherwin-Williams Co.

2.2 PAINT MATERIALS, GENERAL

- A. Material Compatibility: Provide block fillers, primers, undercoats, and finish coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by the manufacturer based on testing and field experience.
- B. Material Quality: Provide the manufacturer's best quality paint material of the various coating types specified. Paint material containers not displaying manufacturer's product identification will not be acceptable.
 - 1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products names are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.
- C. Colors: Provide color selections as scheduled on Drawings.
- D. VOC Content: For applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:
 - 1. Flat Paints and Coatings: 50 g/L.
 - 2. Nonflat Paints and Coatings: 50 g/L.
 - 3. Dry Fog Coatings: 150 g/L.
 - 4. Primers, Sealers, and Undercoaters: 100 g/L.
 - 5. Rust-Preventive Coatings: 100 g/L.
 - 6. Zinc-Rich Industrial Maintenance Primers: 100 g/L.
 - 7. Pretreatment Wash Primers: 420 g/L.
 - 8. Shellacs, Clear: 730 g/L.
 - 9. Shellacs, Pigmented: 550 g/L.
- E. Low-Emitting Materials: For field applications that are inside the weatherproofing system, 90 percent of paints and coatings shall comply with the 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."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.
 - 1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
 - 2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.
- B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
 - 1. Notify the Architect about anticipated problems using the materials specified over substrates primed by others.

3.2 PREPARATION

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
- B. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease prior to cleaning.
 - 1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
 - 1. Provide barrier coats over incompatible primers or remove and reprime.
 - 2. Cementitious Surfaces: Prepare concrete, concrete masonry block, and cement plaster surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required, to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
 - a. Use abrasive blast cleaning methods if recommended by paint manufacturer.
 - b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's printed directions.

3. Wood: clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
 - a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
 - b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and backsides of wood.
 - c. When transparent finish is required, backprime with spar varnish.
 4. Ferrous Metals: Clean ungalvanized ferrous metal surfaces that have not been shop-coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with the Steel Structures Painting Council (SSPC) recommendations.
 - a. Blast steel surfaces clean as recommended by the paint system manufacturer and according to requirements of SSPC-SP 10.
 - b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
 - c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop primer.
 5. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
- D. Materials Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
 2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove film and strain material before using.
 3. Use only thinners approved by paint manufacturer and only within recommended limits.
- E. Tinting: Tint each undercoat a lighter shade to facilitate identification of each coat when multiple coats of the same material 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.

3.3 APPLICATION

- A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
1. Paint colors, surface treatments, and finishes are indicated in the schedules.

2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
 3. Provide finish coats that are compatible with primers used.
 4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
 5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
 7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
 8. Sand lightly between each succeeding enamel or varnish coat.
- B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable and before subsequent surface deterioration.
1. The number of coats and the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
 2. Omit primer on metal surfaces that have been shop primed and touchup painted.
 3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
 4. Allow sufficient time between successive coats to permit proper drying. Do not recoat until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.
- C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
1. Brushes: Use brushes best suited for the material applied. Use brush of appropriate size for the surface or item being painted.
 2. Rollers: Use rollers of carpet, velvet back, or high pile sheep's wool as recommended by the manufacturer for the material and texture required.
 3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.
- D. Minimum Coating Thickness: Apply materials no thinner than the manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.
- E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and in occupied spaces.

- F. Mechanical items to be painted include, but are not limited to, the following:
1. Piping, pipe hangers, and supports.
 2. Ductwork.
 3. Insulation.
 4. Motors and mechanical equipment.
 5. Accessory items.
- G. Electrical items to be painted include, but are not limited to, the following:
1. Conduit and fittings.
 2. Switchgear.
 3. Panelboards.
- H. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.
- I. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and has not been prime coated by others. Recoat primed and sealed substrates where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.
- J. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
- K. Completed Work: Match approved samples for color, texture and coverage. Remove, refinish, or repaint work not complying with requirements.

3.5 CLEANING

- A. Clean-Up: At the end of each work day, remove empty cans, rags, rubbish, and other discarded paint materials from the site.
1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

3.6 PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect.
- B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
1. At completion of construction activities of other trades, touch-up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.7 EXTERIOR PAINT SCHEDULE

- A. Exterior Ferrous Metal, Primed and Unprimed, Latex:
 - 1. Primer: One coat Moore V331 Corotech Acrylic DTM Enamel Semi-Gloss.
 - 2. Finish: One coat Moore V331 Corotech Acrylic DTM Enamel Semi-Gloss.
- B. Exterior Galvanized Metals, Latex:
 - 1. Primer: One coat Moore V110 Corotech Acrylic Metal Primer.
 - 2. Finish: Two coats Moore V331 Corotech Acrylic DTM Enamel Semi-Gloss.
- C. Exterior Gypsum Board, Latex:
 - 1. Primer: one coat Moore Fresh Start High-Hiding All Purpose Primer.
 - 2. Finish: Two coats Moore Ultra Spec HP D.T.M. Acrylic Semi-Gloss Enamel.

3.8 INTERIOR PAINT SCHEDULE

- A. Interior Gypsum Board:
 - 1. Primer: One coat Moore 0550 Regal Select Interior Pearl Finish.
 - 2. Finish: One coat Moore 0550 Regal Select Interior Pearl Finish.
- B. Interior Medium Duty Door/Trim, Including Gypsum Board and Soffits:
 - 1. Primer: One coat Moore V331 Corotech Acrylic DTM Enamel.
 - 2. Finish: One coat Moore V331 Corotech Acrylic DTM Enamel.
- C. Interior Medium Duty Vertical/Overhead; Hard to Paint Surfaces, Hard Glossy Surfaces:
 - 1. Primer: One coat Moore V331 Corotech Acrylic DTM Enamel.
 - 2. Finish: One coat Moore V331 Corotech Acrylic DTM Enamel.
- D. Interior Transparent Finish on Wood:
 - 1. Primer: One coat Moore N423 Benwood Stays Clear Acrylic Polyurethane.
 - 2. Finish: One coat Moore N423 Benwood Stays Clear Acrylic Polyurethane.
- E. Interior Wood, Opaque, Latex:
 - 1. Primer: One coat AQ-0400 Insl-X Aqua Lock Plus Acrylic Primer Sealer.
 - 2. Finish: Two coats 0550 Regal Select Interior Pearl Finish.
- F. Interior Ferrous Metals, Primed and Unprimed, Latex:
 - 1. Primer: One coat Moore V331 Corotech Acrylic DTM Enamel Semi-Gloss.
 - 2. Finish: One coat Moore V331 Corotech Acrylic DTM Enamel Semi-Gloss.
- G. Interior Galvanized Metals, Latex:
 - 1. Primer: One coat Moore V331 Corotech Acrylic DTM Enamel Semi-Gloss.
 - 2. Finish: One coat Moore V331 Corotech Acrylic DTM Enamel Semi-Gloss.

H. Interior Concrete and Masonry, Opaque, Latex:

1. Primer: One coat Moore 958-11 Coronado Super Kote 5000 Latex Blockfiller.
2. Finish: Two coats Moore 0551 Regal Select Interior Semi-Gloss Finish.

END OF SECTION 099100

SECTION 102800 - TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes bathroom toilet accessories.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated. Include the following:
 - 1. Construction details and dimensions.
 - 2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - 3. Material and finish descriptions.
 - 4. Features that will be included for Project.
 - 5. Manufacturer's warranty.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify products using designations indicated.
- C. Warranty: Sample of special warranty.
- D. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.3 QUALITY ASSURANCE

- A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

1.4 COORDINATION

- A. 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.

1.5 WARRANTY

- A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.
- B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.
- C. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.
- D. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- E. 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.
- F. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.
- G. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.2 BATHROOM ACCESSORIES

- A. Basis-of-Design Products: Refer to Toilet Accessory Schedule on Drawings.

2.3 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 102800

SECTION 104413 - FIRE EXTINGUISHER CABINETS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fire protection cabinets for the following:
 - a. Portable fire extinguishers.
- B. Related Sections:
 - 1. Section 104416 "Fire Extinguishers."

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated. 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.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1.3 COORDINATION

- 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.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
- B. Stainless-Steel Sheet: ASTM A 666, Type 304.
- C. Transparent Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), 3 mm thick, with Finish 1 (smooth or polished).

2.2 FIRE PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher.
 - 1. Products: Provide one of the following:
 - a. J. L. Industries, Inc.; Panorama 1035C70.
 - b. Larsen's Manufacturing Company; Gemini GSS2409R2-C.
- B. Cabinet Construction: Nonrated.
- C. Cabinet Material: Steel sheet.
- D. Recessed Cabinet: Cabinet box recessed in walls of sufficient depth to suit style of trim indicated.
 - 1. Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
- E. Cabinet Trim Material: Stainless-steel sheet.
- F. Door Material: Stainless-steel sheet.
- G. Door Style: Fully glazed, frameless, backless, acrylic panel.
- H. Door Glazing: Acrylic sheet.
 - 1. Acrylic Sheet Color: Clear transparent acrylic sheet.
- I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
- J. Accessories:
 - 1. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.
 - a. Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER."
 - 1) Location: Applied to cabinet door glazing.
 - 2) Application Process: Decals.
 - 3) Lettering Color: Red.
 - 4) Orientation: Vertical.
- K. Finishes:
 - 1. Manufacturer's standard baked-enamel paint for interior of cabinet.
 - 2. Steel: Baked enamel or powder coat.
 - 3. Stainless Steel: No. 4.

2.3 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.
- 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 thick.
 - 2. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 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.

2.5 STEEL FINISHES

- A. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning". After cleaning, apply a conversion coating suited to the organic coating to be applied over it.
- B. 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.
 - 1. Color: White.

2.6 STAINLESS-STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1. Run grain of directional finishes with long dimension of each piece.
 - 2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - 3. Directional Satin Finish: No. 4.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where recessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for recessed 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 acceptable to authorities having jurisdiction.
- B. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Unless otherwise indicated, provide recessed fire protection cabinets. If wall thickness is not adequate for recessed cabinets, provide semirecessed fire protection cabinets.
 - 2. Fasten mounting brackets to inside surface of fire protection cabinets, square and plumb.
- C. Identification: Apply decals at locations indicated.

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 manufacturer's 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 104413

SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes portable, fire extinguishers and mounting brackets for fire extinguishers.
- B. Related Requirements:
 - 1. Section 104413 "Fire Protection Cabinets."

1.2 SUBMITTALS

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.
- B. Warranty: Sample of special warranty.
- C. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.
- D. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.3 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers 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: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated. Provide one of the following products:
 - 1. JL Industries, Inc.; 10E.
 - 2. Larsens Manufacturing Company; MP10.
 - 3. Valves: Manufacturer's standard.
 - 4. Handles and Levers: Manufacturer's standard.
 - 5. 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 4-A:60-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.3 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.
 - 1. Manufacturer: Same as selected fire extinguisher manufacturer.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location; locate as indicated by Architect. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface. Vertical orientation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction. Install mounting brackets 54 inches above finished floor to top of fire extinguisher.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

SECTION 122413 - ROLLER WINDOW SHADES

PART 1 - GENERAL

A. Section Includes:

1. Motor-operated roller shades with single rollers.

1.2 SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. 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.

C. Samples for Verification: For each type of roller shade.

1. Shadeband Material: Not less than 10 inches square. Mark interior face of material if applicable.

D. Product Schedule: For roller shades. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of shadeband material.

C. Product Test Reports: For each type of shadeband material, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roller shades to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

1.6 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.

1.7 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 MOTOR-OPERATED, SINGLE-ROLLER SHADES

- A. Basis of Design Manufacturer: MechoShade Systems, Inc.
- B. Motorized Operating System: Provide factory-assembled, shade-operator system of size and capacity and with features, characteristics, and accessories suitable for conditions indicated, complete with electric motor and factory-rewired motor controls, power disconnect switch, enclosures protecting controls and operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.
 - 1. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Electric Motor: Manufacturer's standard tubular, enclosed in roller.
 - a. Electrical Characteristics: As indicated on Drawings.
 - b. Maximum Total Shade Width: As required to operate roller shades indicated.
 - c. Maximum Shade Drop: As required to operate roller shades indicated.
 - d. Maximum Weight Capacity: As required to operate roller shades indicated.
 - 3. Remote Control: Electric controls with NEMA ICS 6, Type 1 enclosure for recessed or flush mounting. Provide the following for remote-control activation of shades:
 - a. Keyed Control Station: Keyed, maintained-contact, three-position, switch-operated control station with open, close, and off functions. Provide two keys per station.

4. Limit Switches: Adjustable switches interlocked with motor controls and set to stop shades automatically at fully raised and fully lowered positions.
- C. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate 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 (exterior face) of roller.
 3. Shadeband-to-Roller Attachment: Manufacturer's standard method.
- D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- E. Shadebands:
1. Shadeband Material: Light-filtering fabric.
 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
 - a. Type: Exposed with endcaps and integral light seal at bottom where it meets the sill.
 - b. Color and Finish: As selected by Architect from manufacturer's full range.
- F. Installation Accessories:
1. Recessed Shade Pocket: Rectangular, extruded-aluminum enclosure designed for recessed ceiling installation; with front, top, and back formed as one piece, end plates, and removable bottom closure panel.
 - a. Height: Manufacturer's standard height required to enclose roller and shadeband assembly when shade is fully open, but not less than height indicated on Drawings.
 2. Closure Panel and Wall Clip: Removable aluminum panel designed for installation at bottom of site-constructed ceiling recess or pocket and for snap-in attachment to wall clip without fasteners.
 - a. Closure-Panel Width: As indicated on Drawings.
 3. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.3 SHADEBAND MATERIALS

- A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.
1. Source: Roller shade manufacturer.
 2. Product: ThermoVeil 1300.
 3. Type: PVC-coated polyester.
 4. Weave: Basketweave.

5. Weight: 16.8 oz./sq. yd.
6. Roll Width: To suit opening width.
7. Orientation on Shadeband: As indicated on Drawings.
8. Openness Factor: 5 percent.
9. Color: As indicated on Drawings.

2.4 ROLLER SHADE FABRICATION

- A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, 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:
 1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch, plus or minus 1/8 inch.
 2. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.
- C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible, except as follows:
 1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, locations of connections to building electrical system, and other conditions affecting performance of the Work.
- 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.
 1. Opaque Shadebands: Located so shadeband is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.
- B. Electrical Connections: Connect motor-operated roller shades to building electrical system.
- C. Roller Shade Locations: As indicated on Drawings.

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.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated roller shades.

END OF SECTION 122413

SECTION 123623 - PLASTIC-LAMINATE-CLAD COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes plastic-laminate countertops.

1.2 SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. Product Certificates: For materials manufactured within 100 miles of Project, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each raw material.
 - 3. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
 - 4. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
 - 5. Product Data: For installation adhesives, indicating VOC content.
 - 6. Laboratory Test Reports: For installation adhesives, indicating compliance with requirements for low-emitting materials.
 - 7. Laboratory Test Reports: For composite wood products, indicating compliance with requirements for low-emitting materials.
- C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
 - 1. Show locations and sizes of cutouts and holes for items installed in plastic-laminate countertops.
 - 2. Apply AWI Quality Certification Program label to Shop Drawings.
- D. Qualification Data: For fabricator.
- E. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.3 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
- B. Installer Qualifications: Fabricator of products.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver countertops until painting and similar operations that could damage countertops have been completed in installation areas. If countertops must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install countertops 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. Field Measurements: Where countertops 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.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE COUNTERTOPS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades indicated for construction, installation, and other requirements.
 - 1. Provide labels from AWI certification program indicating that countertops comply with requirements of grades specified.
- B. Grade: Premium.
- C. Regional Materials: Wood products shall be manufactured within 100 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site.
- D. Certified Wood: Wood products shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-001 and FSC STD-40-004.
- E. High-Pressure Decorative Laminate: NEMA LD 3, Grade HGS.
 - 1. Manufacturers: As scheduled on Drawings.
- F. Colors, Patterns, and Finishes: As scheduled on Drawings.
- G. Edge Treatment: As indicated.
- H. Core Material: Exterior-grade plywood.
- I. Core Thickness: 3/4 inch.
- J. Backer Sheet: Provide plastic-laminate backer sheet, NEMA LD 3, Grade BKL, on underside of countertop substrate.

2.2 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard unless otherwise indicated.
- B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of countertop and quality grade specified unless otherwise indicated.
 - 1. Composite Wood Products: Products shall be made using ultra-low-emitting formaldehyde resins as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.
 - 2. Softwood Plywood: DOC PS 1.

2.3 MISCELLANEOUS MATERIALS

- A. Adhesives: Use adhesives that meet 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."
- B. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.
 - 1. Adhesive for Bonding Edges: Hot-melt adhesive.
- C. Installation Adhesive:
 - 1. Adhesives shall have a VOC content of 70 g/L or less.
 - 2. Adhesive 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."

2.4 FABRICATION

- A. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch over base cabinets. Ease edges to radius indicated for the following:
- B. Complete fabrication, including assembly, 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.
- C. Shop cut openings to maximum extent possible to receive 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.
 - 1. Seal edges of openings in countertops with a coat of varnish.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition countertops to average prevailing humidity conditions in installation areas.
- B. Before installing countertops, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

- A. Grade: Install countertops to comply with same grade as item to be installed.
- B. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop. Provide cutouts for electrical work and similar items.
- C. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.
 - 1. Secure field joints in plastic-laminate countertops with concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.
- D. Install countertops level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
- E. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- F. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
 - 1. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 - 2. Seal junctures of tops, splashes, and walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective countertops, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean countertops on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 123623

SECTION 124813 - ENTRANCE FLOOR MATS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Roll-up rail mats.
 - 2. Recessed frames.

1.2 COORDINATION

- A. Coordinate size and location of recesses in concrete to receive floor mats and frames.

1.3 SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for floor mats and frames.
- B. Maintenance Data: For floor mats and frames to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 ROLL-UP RAIL MATS

- A. Basis-of-Design Product: Construction Specialties; Pedimat AA.
- B. Roll-up, Aluminum-Rail Hinged Mats: Extruded-aluminum tread rails 2 inches wide by 3/8 inch thick, sitting on continuous vinyl cushions.
 - 1. Tread Inserts: 1/4-inch high, 28-oz./sq. yd. weight, level-cut, nylon-pile, fusion-bonded carpet.
 - 2. Colors, Textures, and Patterns of Inserts: As scheduled on Drawings.
 - 3. Rail Color: Clear anodic.
 - 4. Hinges: Aluminum.
 - 5. Mat Size: As indicated.

2.2 FRAMES

- A. Recessed Base Frames: Manufacturer's standard extrusion.
 - 1. Extruded Aluminum: ASTM B 221, Alloy 6061-T6 or Alloy 6063-T5, T6, or T52. Clear anodic color.
 - 2. Provide manufacturer's recommended latex leveling screed for setting frame and providing level surface for mats.
 - 3. Provide manufacturer's standard square end vinyl trim closure between base frame and mat.

2.3 CONCRETE FILL AND GROUT MATERIALS

- A. Provide concrete fill and grout equivalent in strength to cast-in-place concrete slabs for recessed mats and frames. Use aggregate no larger than one-third fill thickness.

2.4 FABRICATION

- A. Floor Mats: Shop fabricate units to greatest extent possible in sizes indicated. Unless otherwise indicated, provide single unit for each mat installation; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints.
- B. with corner connectors, splice plates or connecting pins, and postinstalled expansion anchors.
- C. Recessed Frames: As indicated, for permanent recessed installation, complete with corner pins or reinforcement and anchorage devices.
- D. Coat concealed surfaces of aluminum frames that contact cementitious material with manufacturer's standard protective coating.

2.5 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and floor conditions for compliance with requirements for location, sizes, minimum recess depth, and other conditions affecting installation of floor mats and frames.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install recessed mat frames to comply with manufacturer's written instructions. Set mat tops at height recommended by manufacturer for most effective cleaning action; coordinate tops of mat surfaces with bottoms of doors that swing across mats to provide clearance between door and mat.
 - 1. Install necessary shims, spacers, and anchorages for proper location, and secure attachment of frames.
 - 2. Install monolithic latex leveling screed to completely fill recess area.

3.3 PROTECTION

- A. After completing frame installation and concrete work, provide temporary filler of plywood or fiberboard in recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Substantial Completion.

END OF SECTION 124813

SECTION 210451

GENERAL - FIRE PROTECTION REQUIREMENTS

PART 1 - GENERAL:

1.1 SCOPE:

1.2 RELATED DOCUMENTS:

- A. Division 1 – Section “ALTERNATES”: Coordinate related Division 21 work and modify surrounding work to integrate the Work of each Alternate.

1.3 SUMMARY:

- B. Description of General Fire Protection Requirements. Applies to all Division 21, Section 210450's (Fire Protection).

1.4 DEFINITIONS:

- A. "Provide" means to furnish and install, complete and ready for operation.

1.5 REFERENCES:

- A. ASME: American Society for Mechanical Engineers.
- B. ASTM: American Society of Testing and Materials.
- C. AWWA: American Water Work Association.
- D. FM: Factory Mutual.
- E. NEMA: National Electrical Manufacturer's Association.
- F. NFPA: National Fire Protection Association.
- G. MSS: Manufacturer's Standardization Society of the Valve and Fitting Industry.
- H. UL: Underwriters Laboratories, Inc.

1.6 REGULATORY REQUIREMENTS:

- A. Comply with current edition, unless otherwise noted, of the following codes and standards.
 - 1. ANSI B31.9 - Building Services Piping.
 - 2. ADA - American's with Disabilities Act.
 - 3. NFPA 13 – Installation of Sprinkler System.
 - 4. NFPA 24 – Installation of Private Fire Service Mains and Their Appurtenances
 - 5. NFPA 70 - National Electrical Code.
 - 6. NFPA 101 - Life Safety Code.
 - 7. Applicable State and Local Building, Fire, Mechanical, Plumbing and Gas Codes
- B. Permits, Licenses, Inspections and Fees.

1. Obtain and pay for all permits, licenses, inspections and fees, and comply with all rules, laws and ordinances pertaining to the Contractor's portion of the Work.
2. Obtain and pay for certificates of required inspections, and file certificates with Owner.

1.7 PRODUCT REQUIREMENTS:

- A. Provide new standard, materials throughout.
- B. Multiple items of similar equipment shall be the product of the same manufacturer.
- C. Substitutions:
 1. Comply with the provisions of Division 1, Section "Product Requirements" and the following:
 2. When several manufacturers are named in the specifications, the corresponding products and models made by the specified manufacturers will be accepted and Contractor may base his bid on any one of those products. However, if the Contractor's bid is based on products other than the scheduled or specified basis of design, it shall be understood that there will be no extra cost involved whatsoever, and the effect on other trades has been included in the Contractor's proposal. Coordination with other trades for substituted equipment or use of products other than the named basis of design shall be the responsibility of the Contractor furnishing the equipment.
 3. The basis of design manufacturer's equipment has been used to determine space requirements. Should another approved manufacturer's equipment be used in preparing proposals, Contractor shall be responsible for determining that said equipment will fit space allocated. Submission of shop drawings or product data on such equipment shall be considered as indicating that the Contractor has reviewed the space requirements and the submitted equipment will fit the space allocated with due consideration given to access required for maintenance and code purposes.
 4. The basis of design manufacturer's equipment and scheduled Fire Protection equipment electrical requirements have been used to coordinate the electrical requirements of the plumbing equipment with the electrical systems serving that equipment.
 - a. Contractor shall coordinate the electrical requirements of the equipment actually furnished on this project and provide the electrical systems required by that equipment at no additional cost to the Owner.
 - b. Equipment of higher or lower electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified at no additional cost to the Owner.
 - c. Prior to approval of submittals of Fire Protection equipment with electrical requirements that are greater or lower than those shown on the Drawings, Contractor shall submit letter verifying that required changes to the electrical system, serving the specific piece of equipment in question, have been coordinated with the electrical contractor. Letter to be included with the associated equipment submittal, addressed to the Architect with a copy to the electrical engineer.
 5. Each bidder may submit to the Architect a list of any substitutes which he proposes to use in lieu of the equipment or material named in the specifications with a request for the approval of proposed substitutes. To be considered, such requests must be delivered to the office of the Architect not later than 10 days prior to bid due date. The submittal shall include the following:
 - a. Specific equipment or material proposed for substitution giving manufacturer, catalog and model number.

- b. All performance and dimensional data necessary for comparison of the proposed substitute with the equipment or material specified.
 - c. A statement setting forth any changes in other materials, equipment or other Work that incorporation of the substitute may require.
- 6. The burden of proof of the merit of the proposed substitute is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution is final.

1.8 SUBMITTALS:

- A. Submit under provisions of Division 1, Section "Submittal Procedures" and the following:
- B. Product Data: Submit to the Architect and obtain his approval of a complete list of materials and equipment which are to be provided under the 210455 Sections of Division 21.
 - 1. List shall be complete with manufacturer's names, catalog number, dimensions, specifications, rating data and options utilized. Capacities shall be in the terms specified.
 - 2. Call attention to deviations from specified items as to operation and physical dimensions.
 - 3. Performance curves for pumps shall be included.
 - 4. Final equipment orders shall not be placed until submittals have been returned marked "No Exceptions Noted" or "Make Corrections Noted".
 - 5. Bind all equipment submittals and provide index tab for each type of equipment. Submit all at one time. Reserve two sets for project close-out documents.
- C. Shop Drawings: Before starting work, submit and obtain approval from Architect of detailed drawings of the following, fully dimensioned and drawn to 1/8" to 1'-0" scale. Submit six (6) prints of each drawing. Engineer will return five (5) of the prints with comments noted. Failure to submit shop drawings will make the Contractor responsible for changes required to facilitate installation.
 - 1. Fire Protection Systems. See Division 21, Section "Fire Protection System."
 - 2. For multi-story buildings, submit detailed floor penetration sleeve layout drawings. See Division 21, Section "Plumbing Basic Materials and Methods," Article "Informational Submittals."

1.9 COORDINATION DRAWINGS:

- A. General:
 - 1. Within 60 days of Notice to Proceed provide Coordination Drawings for the following areas of the building:
 - a. Auditorium (Include all Rigging)
 - 2. Do not base Coordination Drawings on reproduction of Contract Documents or standard printed data.
 - 3. Submitted Coordination Drawings are for information only and typically will not be returned to the Contractor. Architect will not take any action, but may define coordination conflicts or problems and inform the Contractor of such conflicts or problems.
- B. Content:
 - 1. Project specific information, drawn accurately to scale.
 - 2. Show sequencing and spatial relationship of separate units of work that must function in a restricted manner to fit in the space provided, or function as indicated.
 - 3. Indicate dimensions shown on Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum

clearance requirements. Provide alternate sketches to Architect for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

- C. Format:
 - 1. Coordination shop drawings shall be drawn to a scale of not smaller than $\frac{1}{4}" = 1'-0"$.
 - 2. Provide drawings on electronic media in AutoCad .dwg format.
 - 3. Provide layering system separate from wall outline and unique to each discipline.
 - 4. In addition to plan view, provide sections as required to clarify congested situations and verify vertical clearances.
 - 5. Base drawings and building sections in .dwg format will be provided by Architect.
- D. Fire Protection Shop Drawings: Fire Protection subcontractor shall add all fire protection equipment, piping, sprinkler heads and other elements to database.
 - 1. Upon completion of Fire Protection shop drawings, transmit electronic database to Electrical subcontractor.
- E. General Contractor's Final Coordination: General Contractor shall thoroughly review shop drawings, adding additional building elements where appropriate, and shall resolve conflicts, coordinating with the Architect, and the various subcontractors.
- F. Submit Coordination Shop Drawings: Upon completion of final coordination, General Contractor shall approve coordination shop drawings and transmit 3 sets of hard copies and electronic files on CD's to Architect.
- G. The Architect will not process fire protection shop drawings until such time as the coordination drawings have been sufficiently completed and conflicts resolved.

1.10 QUALITY ASSURANCE:

- A. Installer's Qualifications: Firm experienced in installation of systems similar in size and complexity to those required for this project, plus the following:
 - 1. Acceptable to, or licensed by, manufacturer.
 - 2. Not less than 3 years experience with systems.
 - 3. Successfully completed not less than 5 comparable scale projects using systems similar to those for this project.
 - 4. Professional Engineer licensed in the State in which the work occurs; or NICET Level 3 and licensed by the State Fire Marshall in the State in which the work occurs. NICET Level 3 designer must be an employee of the Fire Protection Contractor. NICET Level 3 designer must oversee installation of shop drawings.

1.11 SUMMARY OF WORK:

- A. Scope: Provide all labor, materials, equipment and services necessary for the completion of all fire protection work shown or specified, except work specified to be done or furnished by others, complete and ready for operation.

1.12 DRAWING INTERPRETATION AND COORDINATION:

- A. Drawings are intended to show size, capacity, approximate location, direction and general relationship of one phase to another, but not exact detail or arrangement.
- B. Do not scale drawings for location of system components. Check all measurements, location of pipe, ducts, and equipment with the detail architectural, structural, and electrical drawings and conditions existing in the field and lay out work so as to fit in with

- ceiling grids, lighting and other parts.
- C. Make minor adjustments in the field as required to provide the optimum result to facilitate ease of service, efficient operation and best appearance.
- D. Where doubt arises as to the meaning of the Drawings and Specifications, obtain the Architect's written decision before proceeding with parts affected; otherwise assume liability for damage to other work and for making necessary corrections to work in question.
- E. Refer to Architectural Drawings for all dimensions and location of lights, ceiling diffusers and sprinkler heads.

1.13 PROJECT/SITE CONDITIONS:

- A. Visiting Site: Visit site and become familiar with location and various conditions affecting work. No additional allowance will be granted because of lack of knowledge of such conditions.
- B. Determine sizes and locations, and inverts of existing and new utilities near site.
- C. Cause as little interference or interruption of existing utilities and services as possible. Schedule work which will cause interference or interruption in advance with Owner, authorities having jurisdiction, and all affected trades.

1.14 SUBMITTALS FOR PROJECT CLOSEOUT:

- A. Submit under provisions of Division 1 Sections - "Closeout Procedures" and "Project Record Documents" and the following.
- B. Record Drawings:
 - 1. Keep accurate record of corrections, variations, and deviations, including those required by change orders to the Fire Protection drawings.
 - 2. Accurately show location, size and elevation of new exterior work dimensioned from permanent structure.
 - 3. Record changes daily on a set of prints kept at the job site.
 - 4. Submit prints marked as noted above to Architect for review prior to request for final payment.
 - 5. Marked prints will be returned to Contractor for use in preparing Record Drawings.
 - 6. The Fire Protection Contractor shall use marked up drawing showing as-built conditions provided by Contractor to prepare Record Drawings. Asbuilt drawings shall be incorporated on electronic files.
- C. Prior to the issuance of a certificate for final payment, submit to Architect and obtain his approval of the following:
 - 1. Record drawings – fire protection piping/shop drawings, bond and electronic files in AutoCAD *.dwg & PDF format.
 - 2. Equipment Submittal Data (2).
 - 3. Equipment operating and maintenance manuals (2).
 - 4. Equipment warranty dates and guarantees (2).
 - 5. List of Owner's Personnel who have received operating and maintenance instructions.
 - 6. Install valve charts and valve location plans in main mechanical room. (See Division 22, Section "Plumbing Identification.")
 - 7. Submit factory start-up/field reports for:
 - a. Alignment report for flexible-coupled pumps.

- D. Contractor's Material and Test Certificate for above ground piping.

END OF GENERAL - FIRE PROTECTION REQUIREMENTS

SECTION 210453

BASIC FIRE PROTECTION MATERIALS AND METHODS

PART 1 - GENERAL:

1.1 SUMMARY:

- A. Description of common piping, equipment, materials and installation for Fire Protection systems.
- B. This Section includes the following:
 - 1. Piping materials and installation instructions common to most Fire Protection piping systems.
 - 2. Sleeves.
 - 3. Escutcheons.
 - 4. Access doors - Building.
 - 5. Flashing
 - 6. Workmanship.
 - 7. Cutting and patching.
 - 8. Piping systems installation - Common Requirements.
 - 9. Equipment installation - Common Requirements.
 - 10. Painting and finishing.
 - 11. Supports and anchorages.
 - 12. Protection and cleaning of equipment and materials.

1.2 DEFINITIONS:

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.3 SUBMITTALS:

- A. Product Data: For the following:
 - 1. Transition fittings.
 - 2. Escutcheons.
 - 3. Access doors - building.

1.4 INFORMATIONAL SUBMITTALS:

- A. Shop Drawings: For multi-story buildings, submit detailed drawings of the floor penetration sleeve sizes and locations, including the following information:
 - 1. Fully dimensioned off column lines with location relative to adjacent walls shown.
 - 2. Sleeve size.
 - 3. Pipe size.
 - 4. Pipe service.

1.5 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture. If pipes do not ship with end caps, cover ends of pipe stored on site with 6 mil plastic.

1.6 COORDINATION:

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for Plumbing installations.
- B. Coordinate installation of required supporting devices and set sleeves and inserts in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate installation of building access doors for fire protection items requiring access that are concealed behind finished surfaces.
- D. Electrical Characteristics for Fire Protection Equipment:
 - 1. Coordinate electrical system installation to match requirements of equipment actually furnished on this project.
 - 2. Include a letter with the respective equipment submittal from the electrical contractor and approved by electrical design consultant, detailing changes to the electrical system required to accommodate changes in the power distribution system to accommodate Fire Protection equipment that has different electrical power requirements from that equipment used as basis of design, or power provisions, as shown on the electrical drawings.

PART 2 - PRODUCTS:

2.1 MANUFACTURERS:

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements. Provide products by one of the following:

2.2 PIPE, TUBE AND FITTINGS:

- A. Refer to individual Division 15 Fire Protection Piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS:

- A. Refer to individual Division 21 Fire Protection Piping Sections for special joining materials not listed below.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- D. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated.

2.4 SLEEVES:

- A. Galvanized-Steel Sheet: 20 gauge minimum thickness; round tube closed with longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Firestopping Sealant: See Division 7 Sections "Through-Penetration Firestop Systems" and "Fire Resistive Joint Systems" for firestopping sealant requirements.
- D. Stuffing Insulation: Glass fiber type, non-combustible.

2.5 ESCUTCHEONS:

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
 - 1. Finish: Polished chrome-plated.

2.6 ACCESS DOORS – BUILDING:

- A. Manufacturers:
 - 1. Bilco.
 - 2. Milcor.
 - 3. Nystrom.
- B. Construction:
 - 1. Door: 14-gauge, cold rolled steel.
 - 2. Frame: 16-gauge, cold rolled steel of configuration to suit material application.
 - 3. Hinge: Concealed spring hinge.
 - 4. Latch: Screwdriver cam latch.
 - 5. Finish: Phosphate dipped and prime coated.
 - 6. UL labeled when in fire-rated construction with rating to match construction.
 - 7. Stainless steel (Type 304) shall be used in ceramic tile or glazed structural tile.
- C. Size: 16 inch x 16 inch minimum, as indicated on drawings, or as required to allow inspection, service, and removal of concealed items.

2.7 FLASHING:

- A. Flexible Flashing: 47 mil thick sheet butyl compatible with roofing.

- B. Lead Flashing: Waterproofing, 5 lb/SF sheet lead.
- C. Pitch Cups: 20 gauge galvanized steel, minimum 8 inches deep, bases mitered and soldered and extending at least 4 inches horizontally.

PART 3 - EXECUTION:

3.1 WORKMANSHIP:

- A. First class and in accordance with best practice. Work to be orderly, neat, workman-like in appearance and performed by skilled craftsman.
- B. Poor or improper workmanship shall be removed and replaced as directed by the Architect without additional cost to the Owner or design professionals.

3.2 PIPING SYSTEMS INSTALLATION - COMMON REQUIREMENTS:

- A. Install piping according to the following requirements and Division 21 Fire Protection Piping Sections specifying piping systems.
- B. Drawings, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Shop Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas and stairwells.
- D. Install piping indicated to be exposed and in service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections. No mitering or notching for fittings permitted.
- J. Select system components with pressure rating equal to or greater than system operating pressure.
- K. Install escutcheons where exposed piping penetrates walls, ceilings, and floors in finished spaces.

3.3 SLEEVES:

- A. Sleeves are not required for core-drilled holes.
 - 1. In mechanical room floors and other potentially wet areas, provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.
- B. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
 - 1. Cut sleeves to length so that sleeve extends out 1/2 inch from both surfaces.

- a. Exception: Extend sleeves installed in floors of mechanical equipment areas, or other potentially wet areas, 1-1/2 inches above finished floor level. Caulk space outside of sleeves water tight.
 - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 - 3. Use the following sleeve materials:
 - a. Sleeves for Piping Through Concrete Beams, Concrete Walls, Footings, and Potentially Wet Floors: Steel pipe.
 - b. Sleeves for Piping through Masonry Walls and Gypsum Board Partitions: Steel sheet sleeves 1/2 inch larger than pipe or pipe covering.
 - 4. Where piping penetrates non-rated equipment room wall, floors or roofs outside of a shaft, close off space between pipe or duct and adjacent work with stuffing insulation and caulk air tight.
 - 5. Above ground, non-rated, exterior wall penetrations: Seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.
 - 6. Provide for continuous insulation wrapping thru sleeve.
 - 7. Seal space around the outside of sleeves with grout at masonry walls and floors and dry wall mud at gypsum board partitions.
- C. Fire-Rated Penetrations: Where pipes pass through fire-rated and fire-resistive floors, walls, and partitions, install appropriately rated sleeves and firestopping sealant. Firestopping materials and installation methods are specified in Division 7 Sections "Through Penetration Firestop Systems" and "Fire Resistive Joint Systems".

3.4 PIPING JOINT CONSTRUCTION:

- A. Join pipe and fittings according to the following requirements and Division 21 Fire Protection Piping Sections specifying piping systems.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
- D. Flanged Joints:
 - 1. 125 Pound Cast Iron Flange (Plain Face): Mating flange shall have raised face, if any, removed to avoid overstressing the cast iron flange.
 - 2. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.5 PIPE CLEANING:

- A. Keep pipe clean and free of dirt. Keep caps on ends of pipe when it is stored on site and reinstall caps on ends of installed piping at the end of each day.

3.6 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS:

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

- C. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations.
- D. Install equipment in accordance with manufacturer's instructions. If manufacturer's instructions conflict with Contract Documents, obtain Architect's decision before proceeding.
- E. Install equipment to allow right of way for piping installed at a required slope.
- F. All equipment shall be firmly fastened in place:
 - 1. Pad mounted equipment shall be secured to pads using poured in place anchor bolts or cinch anchors.
 - 2. Vibration isolators shall be secured to floors or pads and equipment shall be bolted to the isolators.

3.7 PAINTING AND FINISHING:

- A. Except as specified below or noted on the Drawing, requirements for painting of Fire Protection systems, equipment, and components are specified in Division 9 Sections "Interior Painting" and "Exterior Painting."
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.
- C. Painting of fire piping:
 - 1. The following piping within boiler and chiller room shall be painted in its entirety under Division 9: Painting. Color codes are listed here for information only.
 - a. Fire Protection Piping: Red Metaltex B47R3.
 - 2. Should there be a conflict of colors in existing installations, contact the Architect.

3.8 ERECTION OF METAL SUPPORTS AND ANCHORAGES:

- A. Refer to Division 5 Section "Metal Fabrications" requirements.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing and fire protection materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.9 ACCESS DOORS – BUILDING:

- A. Provide access doors in wall and inaccessible ceilings to allow access to service and maintain concealed Plumbing equipment, valves, etc.
- B. Coordinate installation of access doors with Divisions responsible for Building System in which panels are being installed.

3.10 PROTECTION AND CLEANING OF EQUIPMENT, FIXTURES, AND MATERIALS:

- A. Equipment and materials shall be carefully handled, properly stored, and protected from weather, dust-producing procedures, or damage during construction.
- B. At completion of all work, thoroughly clean exposed materials (pipe, etc.) and equipment and make ready for painting.

END OF BASIC FIRE PROTECTION MATERIALS AND METHODS

SECTION 210455

FIRE PROTECTION SYSTEM

PART 1 - GENERAL:

1.1 SECTION INCLUDES:

- A. Pipe, Fittings, Valves for:
 - 1. Wet sprinkler system.
- B. System design and installation. Base system design hydraulic calculations using the area/density method on the following criteria and in accordance with NFPA 13 latest edition.
 - 1. Sprinkler Protection:
 - a. Office, waiting areas, lobbies, breakrooms, corridors and attics: Light hazard, 0.10 gpm/sq. ft. over the hydraulically most remote 1500 sq. ft.
 - b. Mechanical Equipment Rooms, Transformer Rooms, Electrical Switchgear Rooms, Electric Closets, Elevator Shafts, Elevator Machine Rooms, Refrigeration Service Rooms, and storage between 100 and 250 sq. ft.: Ordinary Hazard, Group 1, 0.15 gpm/sq. ft. over the hydraulically most remote 1500 sq. ft.
 - c. Utility and Maintenance rooms, laundry, laboratory and storage rooms, storage rooms over 250 sq. ft., loading docks, energy centers areas: Ordinary Group 2, 0.20 gpm/sq. ft. over the hydraulically most remote 1500 sq. ft.
 - d. File Storage Areas with "Rolling Files" Racks: Ordinary Group 2 for the entire area of the space up to 1500 sq. ft. area of sprinkler operation.
 - e. Provide sprinklers in accessible shafts per NFPA 13 latest edition.
 - 2. Add water allowance of 250 gpm for inside and outside hose streams to the sprinkler requirements at the connection to the distribution main.
 - 3. Hydraulic Calculations: The calculated demand including hose stream requirements shall fall no less than 10 percent below the available supply curve.
 - 4. Comply with IBC (2009 Edition), NFPA 13, NFPA 24, NFPA 70, National Electric Code, NFPA 72, National Alarm and Signaling Code, and NFPA 101, Life Safety Code (2009 Edition).

1.2 RELATED SECTIONS:

- A. Section 210451 – General Fire Protection Requirements.
- B. Section 210453 – Basic Fire Protection Materials and Methods.

1.3 SYSTEM:

- A. Entire building including attic to be fully sprinkled.

1.4 SUBMITTALS FOR REVIEW:

- A. Submit under provisions of Division 1, Section "Submittal Procedures" and the following:

- B. Product Data: Submit to the Architect and obtain his approval of a complete list of materials and equipment which are to be furnished under Division 21.
 - 1. List shall be complete with manufacturer's names, catalog number, dimensions, specifications, rating data and options utilized. Capacities shall be in the terms specified.
 - 2. Call attention to deviations from specified items as to operation and physical dimensions.
 - 3. Performance curves for equipment such as pumps shall be included.
 - 4. Final equipment orders shall not be placed until submittals have been returned marked "No Exceptions Noted" or "Make Corrections Noted".
 - 5. Bind all equipment submittals and provide index tab for each type of equipment. Submit all at one time. Reserve two sets for project close-out documents.
- C. Shop Drawings:
 - 1. A reflected ceiling plan indicating locations of sprinkler heads, lights, HVAC devices, smoke detectors, exit lights and any additional items attached to ceiling. In lift out ceilings, sprinkler heads are to be centered in ceiling tiles. In hard ceilings, sprinkler heads to follow the general arrangement of the ceiling. After review by the Architect, revise layout as required.
 - 2. Prepare a working pipe shop drawing based on hydraulic calculations. The piping shop drawing shall indicate routing and configuration of piping, size of pipe, piping support, elevation of piping and coordination of piping with ductwork. Shop drawings shall include low point drain downs.
 - 3. Hydraulic calculations are to be prepared utilizing a current water flow test (maximum 90 days old). If current flow test is not available, obtain a current flow test and pay for all fees required.
 - 4. If water flow information is not available due to new main extension or other construction which prohibits the availability of flow information at the start of construction, the contractor shall estimate probable flow information based on information available. Once permanent water is available at the site, the Contractor shall perform a flow test, incorporate the information into the calculation and make any modifications to the system as may be required.
 - 5. When drawings and hydraulic calculations are submitted to the Engineer for review, they shall bear the seals of review and approval of the Architect, General Contractor, the Owners Insurance Underwriter, and the Nicet Level 3 Designer. The Nicet registered designer shall be an employee of the Fire Protection Installing Contractor and shall oversee installation of Project. Nicet registration seal shall be included on shop drawings.
 - 6. Contractor to provide to the State reviewing Agency a set of shop drawings reviewed and approved by Engineer of Record as required by the State of Florida.
 - 7. The Contractor shall incorporate all comments for approval by local Fire Marshall's Office and any State of Florida Reviewing Agency. Contractor shall provide signed, and approved set of plans to Engineer upon approval by state and local authorities.
 - 8. Each system calculations, components and alarming to be on shop drawings.

1.5 SYSTEM INSTALLATION AND INSPECTION:

- A. Required Inspections:
 - 1. All fire line piping must be inspected by owner's representative prior to being covered or concealed.
- B. Fire Stopping:
 - 1. All fire stopping of any and all fire rated assemblies must be inspected and approved by a State Inspector prior to the work being concealed.
- C. Hydrostatic Testing Requirements:
 - 1. The required hydrostatic testing of the underground and above ground fire line piping must be witnessed and approved by City Inspector prior to being covered or concealed.

- D. Acceptance Inspections & Testing:
 - 1. Allow fire protection and life safety systems installation and acceptance test must be inspected, test, witnessed and approved by an AHJ and Owner's representative.
- E. Plans Review & Approval:
 - 1. All fire protection and life safety system drawings and specifications must be reviewed by this office to ensure code compliance prior to start of any work.

1.6 REGULATORY REQUIREMENTS:

- A. Materials: Conform to UL and FM Global Requirements and Standards.
- B. Sprinkler System: Conform to NFPA 13, State, County, City, Fire Marshall Requirements and Local Fire and Rescue Requirements.
- C. NFPA 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances.
- D. NFPA 72, Standard for the Installation, Maintenance and Use of Protective Signaling Systems.
- E. NFPA 72E, Standard on Automatic Fire Detectors.
- F. Applicable Building Codes.
- G. Welding Materials and Procedures: Conform to ASME Code.
- H. Valves: Bear UL, FM label or marking. Provide manufacturer's name and pressure rating marked on valve body.
- I. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.

1.7 EXTRA MATERIALS:

- J. Provide extra sprinklers under provisions of NFPA 13, State and Local requirements.
- K. Provide suitable wrenches for each sprinkler type.
- L. Provide metal storage cabinet in location designated. (Designate location).

PART 2 - PRODUCTS:

2.1 WET SPRINKLER SYSTEM:

- A. Wet System - Above Ground Piping:
 - 1. Black Steel Pipe:
 - a. All piping 1-1/2" and smaller, all piping larger than 1-1/2" with cut grooves on threaded and all welded piping, Schedule 40 black steel ASTM A53, ASTM A795, ASTM A135.
 - b. Piping larger than 1-1/2" for roll grooving only, Schedule 10 ASTM A795, ASTM B36.10. Schedule 10 pipe may not be used for threading or cut grooving. Schedule 7 pipe will not be accepted.

- c. Cast iron threaded fittings ANSI B16.4 cast iron flanges and flanged fittings ANSI B16.1.
- d. Malleable iron threaded fittings, ANSI B16.3.
- e. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts and washers; galvanized for galvanized pipe.
- f. Mechanical Formed Fittings: Carbon steel housing with integral pipe stop and O-ring pocked and O-ring, uniformly compressed into permanent mechanical engagement into pipe.
- g. Malleable Iron Fittings 175 lb. (250 lb.); ASME B16.3, threaded fittings.

Black Steel Piping and fittings shall be domestic manufacturer. Bull Moose Tube, Victaulic, or Wheatland are approved manufacturers. Substitutions require prior approval.

- 2. Copper Tubing: ASTM B75; ASTM B88; Type K, hard drawn.
 - a. Fittings: ASME B16.22, wrought copper and bronze, solder joint, pressure type.
 - b. Joints: AWS A5.8 Classification BCuP-3 or BCuP-4 silver braze.

Copper Piping and fittings shall be domestic manufacturer. Bull Moose Tube, ARGCO, Mueller, or Cerro are approved manufacturers. Substitutions require prior approval

B. Sprinklers - Wet System:

- 1. Sprinklers to be UL approved glass bulb quick response type.
- 2. Suspended Ceiling (Lay-in and Gypsum):
 - a. Manufactures:
 - 1) Viking Model M.
 - 2) Tyco, Reliable, Victaulic.
 - b. Type: Quick response concealed pendant type with painted cover plate.
 - c. Cover Plate: White. Unless indicated otherwise. Provide color chart to Architect for color selection.
 - d. Finish: Sprinkler Head – chrome plated.
 - e. Fusible Link: Glass bulb type temperature rated for specific area hazard.
- 3. Exposed Area Type:
 - a. Manufactures:
 - 1) Viking Model M.
 - 2) Tyco, Reliable, Victaulic.
 - b. Type: Quick response upright type with guard.
 - c. Finish: Brass or chrome plated.
 - d. Fusible Link: Glass bulb type temperature rated for specific area hazard.
 - e. Guards: Finish to match sprinkler finish.

C. Pipe Hangers and Supports:

- 1. Conform to NFPA 13.
- 2. Hangers for Pipe Sizes ½ to 1-1/2 inch: Carbon steel, adjustable swivel, split ring.
- 3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
- 4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- 5. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
- 6. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
- 7. Vertical Support: Steel riser clamp.
- 8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- 9. Copper Plate Support: Carbon steel ring, adjustable, copper plated.

10. All hangers to be a maximum of 12 inches from the end of a branch line or an arm-over for drop.

Pipe hangers and supports shall be of one manufacturer. Grinnell, Anvil or Tolco are approved manufacturers. Substitutions require prior approval.

D. Gate Valves:

1. Up to and including 2 Inches:
 - a. Manufactures:
 - 1) Nibco Model T-104-O.
 - 2) Where Nibco is listed, Victaulic, Stockham, Watts, Tyco and Milwaukee are equal.
 - b. Bronze body, bronze trim 175 psi WP, UL Listed, rising stem, handwheel, solid wedge or disc, threaded ends.
2. Over 2 Inches:
 - a. Manufactures:
 - 1) Nibco Model F-607-OTS.
 - 2) Where Nibco is listed, Victaulic, Watts, Tyco and Milwaukee are equal.
 - b. Iron body, bronze trim 175 psi WP, UL Listed, rising stem pre-grooved for mounting tamper switch, handwheel, OS&Y, solid bronze or cast iron wedge, flanged or grooved ends.

E. Butterfly Valves:

1. Cast or Ductile Iron Body
 - a. Manufactures:
 - 1) Nibco Model GD-4765-4/8.
 - 2) Where Nibco is listed, Victaulic, Watts, Tyco and Milwaukee are equal.
2. Cast or ductile iron, chrome or nickel plated ductile iron or aluminum bronze disc, resilient replaceable EPDM seat, lug, or grooved ends, extended neck, handwheel and gear drive and integral indicating device, and internal tamper switch rated, UL / FM approved.

Tyco, Victaulic, and Reliable are acceptable manufacturers.

2.7 FIRE STOP SYSTEMS:

- A. All wall and floor penetrations are to be closed. Refer to the Arch. Life Safety Plans and close all openings with a U.L. listed assembly compatible with the rating of the wall or floor being penetrated.
- B. Non-rated walls – sheet rock joint compound may be used to seal opening.
- C. For piping passing through listed sheet rock walls or partitions:
 1. Uninsulated pipe passing through 2 hour walls or partitions – minimum 5/8" depth of Hilti FS 605 filling annular space between wall and pipe on both sides of wall. U.L. Listing #WL1056.
 2. Uninsulated pipe passing through 2 hour walls or partitions – minimum 1-1/4" depth of Hilti FS 601 filling annular space between pipe and wall on both sides of wall, U.L. Listing #WL1054.
- D. For piping passing through concrete floors, concrete walls or concrete block walls.
 1. Uninsulated Schedule 40 steel pipe; fill annular space between pipe and opening with Hilti #FS 605. U.L. Listing #CJ1184.

PART 3 - EXECUTION:

3.1 PREPARATION:

- A. Install piping in accordance with NFPA 13 for sprinkler systems.
- B. Connect to site fire service installed under another section. Verify the site with civil drawings for the exact size and location of the service prior to beginning work. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- C. Install piping to conserve building space, to not interfere with use of space and other work.
- D. Group piping whenever practical at common elevations.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. Inserts:
 - 1. Provide inserts for placement in concrete formwork.
 - 2. Provide inserts for suspending hangers from reinforcement concrete slabs and sides of reinforced concrete beams.
 - 3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
 - 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- G. Pipe Hanger and Supports:
 - 1. Install in accordance with NFPA 13 and NFPA 14.
 - 2. Hangers on branch lines to comply with NFPA 13, 9.2.3.
 - 3. Hangers on mains to comply with NFPA 13, 9.2.4.
 - 4. All hangers to be a maximum of 12 inches from the end of a branch line or an arm-over for a drop.
 - 5. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
 - 6. Where several pipes can be installed in parallel and at same elevation, provide multiple trapeze hangers may be used.
 - 7. Provide copper plated hangers and supports for copper piping.
 - 8. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
- H. Slope piping and arrange systems to drain at low points.
- I. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- J. Do not penetrate building structural members unless indicated.
- K. Provide sleeves when penetrating floors and wall. Seal pipe and sleeve penetrations to achieve fire resistance equivalent to fire separation required.
- L. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, unions, and couplings for servicing are consistently provided.

- M. Die cut threaded joints with full cut standard taper pipe threads and connect with Teflon tape or Teflon pipe compound applied to male threads.
- N. Install valves with stems upright or horizontal, not inverted.
- O. Provide valves for shut-off or isolating service and where shown on plans.
- P. Provide drain valves at main shut-off valves, low points of piping and apparatus.
- Q. Install piping in attic directly on top of joists. Install plastic sheeting over top of pipe and secure joists. Insulation to be installed over pipe and plastic sheeting.
- R. Exterior exposed equipment shall be chrome plated.
- S. All fire department or maintenance connections shall be coordinated with the Fire Department.
- T. The fire protection contractor is responsible for coordination and labelling of fire devices supplied under this specification.
- U. Where pipes penetrate exterior or finished surfaces escutcheons shall be used. Escutcheons shall be chrome finished and single piece design.
- V. All devices and equipment shall be labelled as required by NFPA 13.

END OF FIRE PROTECTION SYSTEM

SECTION 221000 - PLUMBING PIPING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. The work required under this section includes all work necessary for a complete installation of sanitary waste piping, and domestic water piping inside the building to 5 feet outside the building.
- B. The work of this section is subject to the requirements of the Mechanical General Section – Division 23.

1.2 SUBMITTALS:

- A. Submit schedule of pipe and fittings for each service.

1.3 CODES AND STANDARDS:

- A. Applicable State and Local Building Code.

PART 2 - PRODUCTS

2.1 GENERAL:

- A. Refer to design drawings for approximate locations of pipe and for pipe size.
- B. Domestic Water Piping:
 - 1. Water piping within building:
 - a. 3 inch and smaller shall be copper tube, type "L" hard temper, ASTM B-88.
 - 2. Piping below ground:
 - a. 2" and smaller type "K" soft temper; ASTM B-88.
- C. Sanitary Waste, and Vent Piping:
 - 1. Above Ground:
 - a. Hubless cast iron soil pipe, CISPI Standard 301 with heavy duty coupling assembly CISPI Standard 310.
 - b. Schedule 40 PVC-DWV ASTM D-2665 using solvent cement ASTM D2564. Provide fire wrapping as required for return plenum conditions. Verify with mechanical and General Contractor.
 - c. Horizontal piping for fixture rough-ins may be DWV copper, ASTM B-306.
 - 2. Below Ground:
 - a. Cast iron soil pipe, ASTM A74, tar coated inside and outside with gaskets ASTM C-564.
 - b. Schedule 40 PVC-DWV ASTM D-2665 using solvent cement ASTM D2564.
- D. Fittings - Domestic Water Piping:
 - 1. Wrought copper, solder type, ASTM B-75, ANSI B16.22.
- E. Fittings - Sanitary Waste and Vent Piping:
 - 1. Above ground:
 - a. No hub cast iron soil pipe fittings with heavy duty coupling assembly CISPI Standard 310.
 - b. Schedule 40 PVC-DWV, ASTM D-2855 using solvent cement ASTM D-2564.
 - 2. Below ground:
 - a. Cast iron soil pipe fittings ASTM B-74, tar coated inside and outside.
 - b. Schedule 40 PVC-DWV, ASTM D-2855 using solvent cement ASTM D-2564.

- F. Unions:
 - 1. Solder unions shall be wrought copper, with copper ground joint. ASTM B75, ANSI B16.22.
 - 2. Di-electric, EPSO, 250 lb. WOG.
- G. Solder:
 - 1. Solder Metal shall conform to ASTM B32-alloy grade 95TA: 95 percent tin, 5 percent antimony. Joints shall be made with approved solder containing not more than 0.2 percent lead.
- H. Valves:
 - 1. Approved manufacturers: Hammond, Stockham, Crane, Nibco, Apollo, Milwaukee, or approved equal.
 - 2. Valves 2 inches and smaller shall be equal to Nibco T-585-70, full port ball type with bronze body, chrome plated ball and bronze threaded ends, 600 psi WOG or Nibco S-585-70 in copper lines.
 - 3. Cold water shutoff valve serving breakroom sink, or sink closest to refrigerator, shall be provided with extender "Tee" adapter with valve for connection to ice maker water line. Extend and connect water line from refrigerator to valve.
 - 4. Check valves 3 inches and smaller shall be equal to Nibco T-413-B body, bronze disc, swing check, threaded ends, 200 psi WOG or Nibco S-413-B in copper lines.

PART 3 - EXECUTION

3.1 GENERAL:

- A. All piping shall be routed to conserve building space, be coordinated with items installed by other trades and not interfere with access to or operation of the facility.
- B. Provide roof flashings for pipe penetrations through roof, to be installed by roofing contractor.
- C. Water piping within building shall be size indicated on plans and risers. In the event no size is shown, pipe size or size required by the Plumbing Code. Piping shall be sloped toward a system drain and toward outlets, to provide for system drain-down. If installed near exterior walls, piping shall be located on the interior side of insulation. Install piping to prevent direct contact between ferrous and non-ferrous materials. Allow flexibility for expansion in piping.
- D. Domestic water piping system shall be tested with potable water at a pressure of 125 psig or 25 psig above design working pressure, whichever is greater for 12 hours. Test shall be conducted with plumbing inspector unless approved otherwise in writing.
- E. Water distribution piping shall be disinfected prior to occupancy or system start-up with a chlorine solution 50 ppm. Allow system to stand for six hours minimum; then exercise all valves to ensure treatment of all branches and components. System shall be flushed with potable water after disinfection and prior to placement into service.
- F. Sanitary waste and vent piping shall be tested in accordance with water and air tests as specified in the SBCCI Standard Plumbing Code, in addition to any tests required by the local plumbing official. (10 feet of head with no apparent leaks. Hold for 30 minutes minimum). Flush all gravity piping including floor drains prior to turning over to the Owner.

3.2 PREPARATION:

- A. All pipe shall be cut square. Ream pipe and tube ends and remove burrs. Clean the ends of pipes to remove oil, grease and oxides.
- B. Prepare piping connections to equipment with flanges or unions.

- C. All soldered piping and equipment connections shall be properly prepared in accordance with good piping practice. Apply a thin layer of flux to only the male tubing. Rotate into the fitting with one or two revolutions.

3.3 INSTALLATION:

A. Domestic Water Piping:

1. Route piping in orderly manner, plumb and parallel to building structure, and maintain gradient.
2. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
3. Provide clearance for installation of insulation and access to valves and fittings.
4. Provide access where valves and fittings are not exposed.
5. Install valves with stems upright or horizontal. Provide drain valves at low points in systems.
6. Test cold water piping before being insulated or concealed in walls or ceiling.

B. Sanitary Waste, and Vent Piping:

1. Horizontal soil, waste and drainage lines within building shall have a minimum uniform slope of 1/8 inch per foot on 4 inch and larger, and 1/4 inch per foot on lines 3 inch and smaller.
2. Turns in sanitary, soil, and drain piping shall be made using 45 degree elbows, wyes, quarter-, eighth-, or sixteenth bends, or other bends approved by the Plumbing Code.
3. Do not use sanitary tees or crosses except where discharging from horizontal to vertical.
4. Make changes in pipe sizes with reducing fittings and recessed reducers. Do not reduce line size in direction of flow.
5. Provide cleanouts in all horizontal turns in waste piping greater than 45 degrees.
6. Provide deep seal traps on all floor drains, and trap primers where required by code or as indicated on drawings.
7. Indirect waste lines dumping into floor or hub drains shall maintain a 2-inch air gap between the end of the waste line and the rim of the floor or hub drain.

3.4 APPLICATION:

- A. Install unions downstream of valves and at equipment or apparatus connections. Install dielectric unions where joining dissimilar materials.
- B. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- C. Install brackets at cast iron no hub cleanouts to protect the integrity of the joint.

END OF SECTION 221000

SECTION 221119 - PLUMBING SPECIALTIES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. This specification describes the requirements for labor and materials required for the installation of plumbing specialties included as part of the building plumbing system.

1.2 SUBMITTALS:

- A. Manufacturer's literature indicating model numbers and options.
1. Cleanouts
 2. Water Hammer Arresters
 3. Trap Primers
 4. Pressure Reducing Valves
 5. Roof Drains
 6. Overflow Drains
 7. Downspout Nozzles
 8. Floor Drains
 9. Backflow Preventer
 10. Wall Hydrants
 11. Thermostatic Mixing Valve
- B. Format shall include a schedule of the specialties submitted and include identification number of each item, such as "FD-1 Floor Drain", a list of each component, accessory, and option of the item being submitted. This schedule must be included in the front of the submittal page.

PART 2 - PRODUCTS

2.1 CLEANOUTS:

- A. Cleanouts shall consist of a coated cast iron body with threaded top with spigot or no-hub connection and gasketed bronze closure plug with countersunk slot. Head shall be adjustable in height; provide non-skid covers for floor cleanouts. Provide thread shield to protect adjustment threads from concrete as required.

B. Cleanout Covers

<u>Location</u>	<u>Adjacent Finish</u>	<u>Material</u>	<u>Features</u>
Interior	Terrazo	Nickel Bronze	Round Recessed Top
Interior	Tile	Nickel Bronze	Square Recessed Top
Interior	VCT	Nickel Bronze	Square Recessed Top
Interior	Carpet	Nickel Bronze	Round, Carpet Marker
Interior	Concrete	Nickel Bronze	Round
Exterior	Concrete	Cast Iron	Vandal Proof Secured Top
Wall	All	Chrome Plated	Covers

- C. Cleanouts shall be Jay R. Smith, Wade, Josam, Zurn or MIFAB.

2.2 MISCELLANEOUS:

- A. Water Hammer Arrestors shall be constructed of a stainless steel or copper shell, stainless steel or elastomer bellows, with pre-charge of air, nitrogen, or argon. Arresters shall conform to ASSE Std. 1010, and shall be Zurn "Shoktrol", Josam "Absorbotron", Wade "Shokstop", or Precision Plumbing Products "Shock Arrestor". Sizing shall be according to PDI Standards.

- B. Pressure Reducing Valves (Domestic Water)
 - 1. Pressure Reducing Valves 2 inch and smaller shall be equal to Watts Series U5B-GG bronze body single seated with composition diaphragm and stainless steel spring, direct acting with strainer on inlet side, integral by-pass check valve, gauge, and threaded ends.
- C. Trap Primers
 - 1. Trap Primer to prime multiple traps. Automatic brass trap primers activated by a drop in building water pressure, with trap primer distribution unit. P-1 or P-2 Primer with DU-2, 3, or 4 Distribution Unit by Precision Plumbing Products, Inc. or approved equal; Zurn, Smith, Josam are acceptable manufacturers. ASSE Standard 1018.
 - 2. Trap Primer to prime single trap. Automatic brass trap primer activated by a drop in building water pressure. P-2 Primer as manufactured by Precision Plumbing Products, Inc. or approved equal Manufacturers. ASSE Standard 1018.

2.3 ROOF DRAINS:(RD)

- A. RD: Roof drains shall consist of coated cast iron body with non-puncturing flushing clamp with integral gravel stop and deck clamp. Drain shall have an adjustable extension to place flashing clamp above insulation while body rests on the roof structure. Provide aluminum roof dome. Provide 1710 expansion joint if piping is not offset below the roof, Jay R. Smith 1015Y-R-C-AD, Wade, Josam, and Zurn are approved equal.

2.4 OVERFLOW DRAINS:(RD)

- A. OD: Overflow drains shall consist of coated cast iron body with non-puncturing flushing clamp with integral gravel stop and deck clamp. Drain shall have an adjustable extension to place flashing clamp above insulation while body rests on the roof structure. Provide aluminum roof dome. Provide 1710 expansion joint if piping is not offset below the roof, Jay R. Smith 1080Y-R-C-AD, Wade, Josam, and Zurn are approved equal.

2.5 DOWNSPOUT NOZZLES:

- A. Downspout nozzle shall be cast bronze. Provide with bird screen. Jay R. Smith 1770, Wade, Josam, and Zurn are approved equal.

2.6 FLOOR DRAINS:(FD)

- A. FD-1: Floor drain, square. Coated cast iron body with bottom outlet, 1/2" trap primer connection, combination invertible membrane clamp and adjustable collar with polished nickel-bronze light duty strainer top with square heelproof openings and secured grate. Zurn FD-2211-ST or approved equal by Smith, Wade, Josam, and MIFAB.
- B. FD-2: Medium duty drain with Sur-Set bucket, 9" diameter medium duty cast iron grate, coated cast iron body, 2" trap primer connection, bottom outlet, seepage pan, and combination membrane clamp. Zurn Z-554-P-NH or approved equal by Wade, Josam, Zurn, and MIFAB.

2.7 BACKFLOW PREVENTERS:

- A. Reduced Pressure Zone Assembly (Meeting ASSE 1015)
 - 1. 2-inch and smaller. NPT body connections, quarter turn, full port, resilient seated bronze ball valve, and strainer.
 - 2. Wilkins, Febco, and Conbraco are approved equal.

2.8 WALL HYDRANTS:

- A. General: Wall hydrants shall be bronze, with integral vacuum breaker, 3/4" inch hose thread, key operator. Units shall be non-freeze type. Jay R. Smith, Wade, Josam, Zurn, or MIFAB.

- B. Exposed Wall Hydrant (WH-1): Nickel bronze plated, quarter turn. Jay R. Smith 5609 QT.

2.9 THERMOSTATIC MIXING VALVE ASSEMBLY:

- A. Small thermostatic mixing valves.
- B. Rough bronze finish.
- C. Point of use type meeting ASSE 1070.
- D. Refer to plans for type specification.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. CLEANOUTS:

1. Cleanouts shall be installed in horizontal runs at spacing of no more than 75 feet. Install cleanouts at the base of every soil and waste stack, and at each 90 degree change in direction. Install cleanouts which are not easily accessible up through floor or wall and provide applicable covers. Install cleanouts to allow at least 18" for rodding.

B. MISCELLANEOUS:

1. Water hammer arrestors shall be sized to actual pipe size and installed as near the shock source as practical. Install to allow unobstructed path from shock source to arrestor.
2. Trap primers shall be provided for all floor drains and floor sinks. Install trap primer valves and accessories per manufacturer's instructions. Trap primers shall be installed level and in accessible locations. Provide Distribution Units as required.
3. Install Pressure Reducing Valves where shown on drawings. Set final outlet pressure for 60 psi unless otherwise indicated. Install in horizontal and accessible location. Install shut off valves and strainer (unless integral with unit) upstream of pressure reducing valve and shut off valve downstream of the pressure reducing valve. Install pressure gage, unless integral with unit, downstream of pressure reducing valve.

C. ROOF/OVERFLOW DRAINS:

1. Roof drains shall be installed as recommended by the manufacturer. Coordinate the work with roof deck and roofing contractors to insure proper and timely installation.

DOWNSPOUT NOZZLES:

2. Downspout nozzles shall be installed as recommended by the manufacturer. Coordinate the exact location with architectural drawings and general contractor to insure proper and timely installation.

D. FLOOR DRAINS:

1. Locate floor drain FD-1 per architectural floor plan. Orient drain at 45 degree angle and locate at intersection of floor tile. See architectural floor plan for exact location.
2. Flush-floor drains shall be able to support traffic. Drains installed in building floor shall be sealed in such a manner as to prevent leakage of water around trap and body to ceiling below.
3. Provide 3 ft. sq., 6 mil butyl membrane, at each floor drain. Clamp membrane. Membrane shall be placed below tile grout; or, membrane shall be recessed in the floor slab with topping poured over it.

E. BACKFLOW PREVENTERS:

1. Backflow preventers shall be installed by qualified personnel per manufacturer's instructions. After installation, but before system is put into service, test backflow preventer for functionality with test kit as recommended by manufacturer. Pipe discharge from backflow preventer vent to nearest floor drain with connection-size copper tubing.

Ensure air gap is provided in relief line either by air gap fitting or elevated discharge above drain. Backflow preventers shall have unions for removal. Backflow preventers shall be provided on domestic water lines as indicated on the drawings.

F. WALL HYDRANTS:

1. Install wall hydrants as indicated on drawings, minimum height 18" A.F.F. unless otherwise indicated.

G. THERMOSTATIC MIXING VALVES:

1. Install thermostatic mixing valve as indicated on the drawings.

END OF SECTION 221119

SECTION 221123 - GAS PIPING SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. Provide complete installation of gas piping from the "point of delivery" up to and including connection to all gas-fired equipment.

1.2 CODES AND STANDARDS:

- A. 2009 International Fuel Gas Code
- B. NFPA 54 - Fuel Gas Code
- C. AWS/ANSI - D10.9 Qualification of Welding Procedures and Welders for Piping and Tubing.

1.3 SUBMITTALS:

- A. Submit manufacturer's literature on all materials and equipment including:
 - 1. Pipe
 - 2. Valves
 - 3. Fittings
 - 4. Regulators
 - 5. Relief Valves
 - 6. Gauges
 - 7. Motors
 - 8. Coatings

PART 2 - PRODUCTS

2.1 GENERAL

- A. All products shall be UL listed for gas service.

2.2 PIPING AND FITTINGS:

- A. Above Grade:
 - 1. Schedule 40 black steel pipe ASTM A53, Grade A, B, type FBW, ERW or seamless.
 - 2. Malleable iron, ASTM A-197 class 150 fittings, ANSI B16.3 - sizes 2 inches and smaller.
 - 3. Carbon steel butt welded fittings, ASTM-A-234 conforming to ANSI B16.9 sizes 2-2 inches and larger.
- B. Underground:
 - 1. Schedule 40 black steel pipe ASTM A53, Grade A, B, type FBW, ERW or seamless.
 - 2. Carbon steel butt welded fittings, ASTM-A-234 conforming to ANSI B16.9 sizes 2-2 inches and larger.
 - 3. Carbon steel ASTM - A181 forged socket weld fittings, 2 inch and smaller. 3,000 psi, conforming to ANSI B16.11.
- C. Coating:
 - 1. X-Tru Coat

2.3 UNIONS (DIELECTRIC):

- A. Class 250 malleable, screwed ASTM A-197.

2.4 VALVES:

- A. 1-Inch and Smaller:
 - 1. Ball valve - Class 125 brass full port, 2 piece body, chrome plated ball, blow-out proof stem, TFE seats.
- B. 2-Inches and Smaller:
 - 1. Plug Cock - Class 125 cast iron, screwed, full port AGA listed. ANSI B16.33 Homestead Figure 601.
- C. 2-1/2-Inches and Larger:
 - 1. Plug Cock - Class 125 flanged cast iron ASTM AGA listed ANSI B
- D. Fire Safety Shut-Off Valve.

2.5 PRESSURE REGULATORS:

- A. Valves:
 - 1. Cast iron or aluminum body and spring case with stainless steel valve stem, seat ring and valve plug, plated steel springs, neoprene diaphragm and gaskets and TFE disc. Regulating valves shall be sized for the flow indicated and for inlet and outlet pressures indicated. Outlet pressure shall be maintained under the design flow condition and at no flow. Regulating valves two psi and below shall have leak limiting devices. Regulating valves over two psi shall be vented full size to outside of the building. Other regulating valves requiring access to the atmosphere shall be equipped with vent piping leading to outside. Provide a pressure relief valve if the regulator connection size exceeds two-inches. Regulating valves shall be Fisher, Maxitrol or prior approved equal meeting ANSI Z21.18.
- B. Pressure Gage:
 - 1. For medium pressure gas; 0-5 psi range. For low pressure gas; 0-30 inch W.C. range. Use low pressure type 2-2 inch dial pressure gage with appropriate range, OCI Model CO 34, Terice, Weksler, or approved equal.

PART 3 - EXECUTION

3.1 GENERAL:

- A. Coordinate installation of gas service line with the local gas utility company. Pay all fees.
- B. Perform work in accord with the applicable A.G.A., NFPA 54 state and local codes.
- C. Connect to entering line and distribute gas to equipment items requiring gas and as indicated. Install gas stop valves and drip legs at each equipment item. Piping shall be adequately drained with a minimum slope of 1/4-inch per 15-feet and drip legs (full size of pipe) installed at additional points where condensate may collect. Install gas shut off valve and pressure gage inside building at entry. Install pressure reducing valves as required to provide pressure within equipment manufacturer's requirements.

3.2 SERVICE:

- A. Provide 12-inch elevated meter mounting pad on top of a 4-inch thick concrete pad for support of gas meter and piping.

3.3 CONCEALED PIPING:

- A. Provide access panels for valves and other items requiring maintenance in enclosed spaces. See Section titled "Basic Mechanical Material and Methods" for access panel specification. Avoid installing gas appurtenances in enclosed spaces where possible. Install in enclosed spaces only as allowed by applicable codes.

3.4 VENT PIPING FROM REGULATORS:

- A. Extend separate full size vent pipes from each regulator outside. Terminate each vent separately with a screened opening.

3.5 OUTDOOR PIPING:

- A. Piping installed outdoors shall be prime coat painted after installation.
- B. Paint shall be alkyd-enamel.

3.6 TESTING:

- A. Pneumatic Pressure Test
- B. Leak Test

END OF SECTION 223112

SECTION 223000 - PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. This specification describes the requirements for labor and materials necessary for the installation of plumbing equipment included as part of the building plumbing system.
- B. The work of this section is subject to the requirements of the Division 23 - Mechanical General.

1.2 SUBMITTALS:

- A. Submittals shall include:
 - 1. Water Heaters
 - a. Manufacturer's Data Sheets
- B. Format shall include a schedule of the items of equipment submitted and include identification number of each item, such as "WH-1 Water Heater", and list of each component, accessories, and options. Include the schedule in the front of the submittal package.

PART 2 - PRODUCTS

2.1 WATER HEATERS: Electric

- A. Provide Lochinvar, A. O. Smith, State, or prior approval equal water heater with storage and recovery capacities indicated. Storage tank shall be glass lined with magnesium tank savers and constructed according to ASME Code for 125 psi working pressure. The heater shall be factory insulated with a baked enameled steel jacket. Provide with, ASME temperature and pressure relief valve, and three year standard commercial guarantee. Install temperature gauge on leaving side of heater. Water heaters shall comply with ASHRAE 90 lb. - 1992 for efficiency and stand-by heat loss.

2.2 THERMAL EXPANSION TANK (Domestic Water):

- A. Pre-charged hydropneumatic steel expansion tank stamped with a maximum working pressure of 125 psi, and a maximum working temperature of 200 degrees F. All internal wetted parts must comply with FDA regulations and approvals. An internal butyl diaphragm will be used to isolate air from water. Amtrol or approved equal AST series sized as shown on plans.

PART 3 - EXECUTION

- A. Equipment shall be installed in accordance with manufacturer's recommendation.
- B. See details for mounting instruction and accessories.
- C. Install electric water heaters so elements can be removed without disconnecting and/or removing heater.

END OF SECTION 223000

FIFTH THIRD BANK

223000 - 1

PLUMBING EQUIPMENT

SECTION 224000 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. This specification describes the requirements for plumbing fixtures and their installation.

1.2 SUBMITTALS:

- A. Submittals shall include manufacturer's data sheets and dimensional information on all fixtures and accessories according to Division 23 - Mechanical General.
- B. Format shall include a schedule of the fixtures submitted and include identification number of each item, such as "P-1 Water Closet", and list of each component and accessory of the fixture, including manufacturer's model number. This schedule must be included in the front of the submittal booklet.
- C. All applicable plumbing fixtures shall meet EPA "WaterSense" criteria.
- D. Submittals are required for Plumbing Fixtures and Trim including:
 - 1. Fixtures
 - 2. Faucets
 - 3. Valves (including stops and supplies)
 - 4. Traps

1.3 CODES AND STANDARDS:

- A. American National Standards Institute
- B. ANSI A112.11.1-1973
- C. ANSI A112.18.1M-1979
- D. ANSI A112.19.1M-1979
- E. ANSI A112.19.3-1984
- F. ANSI A112.19.4M-84
- G. ANSI Z124.2-1980
- H. ANSI Z124.3-1986
- I. ANSI Z 124.4-1986
- J. ANSI Z 124.2-1980
- K. ANSI A 112.19.5-1979
- L. Applicable State and Local Building Codes

PART 2- PRODUCTS

2.1 GENERAL:

- A. Vitreous ware shall be white, regular section, of weight required, free from cracks, flaws,

blisters, crazes or other defects. Provide with mounting brackets for wall mounted fixtures unless floor carriers are indicated.

- B. Stainless steel shall have machine ground finish. Decks and sink compartment sides shall be buffed. Exposed surfaces shall have no. 4 satin finish. Interior surfaces shall be deadened. Exposed metal parts shall be chromium plated and protected during construction by a coat of grease.
- C. Lavatory, carriers shall have rectangular structural steel uprights. Carriers shall have necessary accessories for proper installation. Carriers shall be according to ANSI A112.6.1M.
- D. Water closets shall have bolt caps.
- E. Seats shall be white, solid plastic, with internal check and molded stainless steel hinge without visible metal parts, except as hereinafter specified.
- F. Chromium plated traps shall be brass with chromium plated nipple to wall and escutcheon.
- G. Fittings and accessories specified designate type only; provide modifications to make fittings work properly with fixture and piping.
- H. Provide necessary tailpiece and shanks.
- I. Carriers shall have short feet. Lavatory carriers shall have concealed arms. Bolt carrier feet to the floor with 1/2-inch bolts and anchors.
- J. Fixture connections may be made using "Aquaflow" flexible connectors of polymer and stainless steel braided covering.

2.2 FIXTURES

- A. Provide fixtures, in complete working order, as described on the drawing.

2.3 ACCEPTABLE MANUFACTURERS:

- A. Fixtures, Vitreous China - American Standard, Crane, Eljer, Kohler
- B. Fixtures, Stainless Steel - Just, Elkay
- C. Toilet Seats - Olsonite, Sperzel, Church, Beneke, Bemis
- D. Faucets - T&S Brass, Speakman, Chicago, Symmons, Eljer
- E. Trim, Chromed Brass - McGuire, Sanitary Dash, Bridgeport
- F. Carriers - J. R. Smith, Josam, Zurn, Wade
- G. Terrazzo - FIAT, Cutler, Florestone, Stern-Williams
- H. Electric Water Coolers - Elkay, Halsey-Taylor, Sunroc, Oasis, Haws. Use only water coolers which do not use CFC=s for refrigeration.

PART 3 - EXECUTION

3.1 GENERAL:

- A. Verify all dimensions by field measurements. Verify that all plumbing fixtures are installed in accordance with pertinent codes and regulations and reference standards.
- B. Verify location of rough-in for potable water and waste piping.
- C. Examine walls, floors, and millwork for conditions suitable for fixture installation.
- D. Securely anchor bars to metal studs in dry wall construction by angle irons.

3.2 INSTALLATION:

- A. Install plumbing fixture level and plumb, in accordance with fixture manufacturer's published literature, rough-in drawings, codes regulations, and reference standards.
- B. Fasten plumbing fixtures securely to supports or building structure. Rigidly support water supplies behind or within wall constriction.
- C. Provide stop valve in the water supply to each fixture in an accessible location.
- D. Connect fixtures to water supply with copper or brass (no steel).
- E. Each fixture and piece of equipment requiring connection to drainage system to have separate traps installed as close to fixture as possible.
- F. Provide iron or steel backing for all wall mounted fixtures (or wood backing only if building structure is wood).
- G. Provide escutcheons at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.
- H. Apply SCP3154 primer and General Electric Co.'s No. 1702 silicone sanitary sealant around plumbing fixtures to conceal voids at wall and contact points of fixture after walls have been painted.
- I. Apply SCP3154 primer and General Electric Co.'s Silpruf Sealant on plain concrete walls.

3.3 TESTING AND QUALITY CONTROL:

- A. Inspect each unit for damage. Replace damaged fixtures.
- B. Test fixtures to demonstrate operation. Replace malfunctioning units and retest.
- C. Adjust water pressure at faucets, and flush valves to provide proper flow.
- D. Replace washers of leaking or dripping faucets and stops. Clean fixtures, trim, and strainers using manufacturer's recommended cleaning methods and materials.

3.4 CLEANING:

- A. Clean fixtures, trim, and strainers using manufacturer's recommended cleaning methods and materials. Remove labels.

3.5 PROTECTION:

- A. Provide protection covering for installed fixtures, water coolers, and trim.

3.6 MOUNTING HEIGHTS SCHEDULE:

<u>Fixture</u>	<u>Mounting Height</u>
Lavatory or Sink	31 inches floor to rim (34 inches for handicap)
Water Closet	15 inches floor to rim (16-3/4 inches for handicap)
Drinking Fountain	42 inches floor to bubbler (36 inches for handicap)

END OF SECTION 224000

SECTION 230500 - MECHANICAL GENERAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. The "General Conditions", "Supplementary Conditions", Statutory Declarations, Special Conditions and Division 1 of the specifications as written and referred to are adopted and made part of Division 23.

1.2 DESCRIPTION OF WORK:

- A. Provide equipment, labor, material, etc., required to make a complete working installation as shown or as specified.
 - B. Equipment and materials used in the work shall be:
 - 1. In accordance with the contract documents.
 - 2. The best quality and grade for the use intended.
 - 3. New and unused.
 - 4. The manufacturer's latest standard or current model.
 - C. All equipment and method shall be installed and connected in accordance with the best engineering practices and in accordance with the manufacturer's recommendations.
 - D. Mechanical work includes, but is not limited to:
 - 1. Make arrangements with local utility company for services as shown or specified.
 - 2. Obtain all permits and inspections including: building permits, health department permits and sewer tap permits.
 - 3. Disconnect, remove and re-install mechanical services located on or crossing through contract limits, above or below grade, obstructing construction of project or conflicting with completed project or any applicable codes.
 - 4. Complete the domestic water distribution system.
 - 5. Complete the domestic hot and cold water system. Provide sanitary rinse and flush.
 - 6. Provide HVAC System filters and spare sets.
 - 7. Complete the interior sanitary sewer.
 - 8. Install all owner – furnished devices and equipment.
 - 9. Complete insulation on piping, ductwork and equipment.
 - 10. Complete the air handling systems, ventilating systems and fans.
 - 11. Testing and Balancing will be by independent contractor paid for by Division 23.
 - E. Provide vibration isolation devices for all rotating or reciprocating equipment and piping connected to that equipment.
 - 1. Provide roofing including flashing, and counter flashing for roof mounted equipment, roof penetrations and supports for work in this Division, unless noted otherwise.
- #### 1.3 UTILITY CONNECTIONS:
- A. Arrange with local utility companies for utility service connections, taps, meters and installation. Pay all fees and charges (if any) necessary for the utility services shown on the drawings or listed in the specifications.
 - B. It is the responsibility of the Contractor to re-confirm with the Utility Companies, prior to bidding, that locations, arrangements, line sizes, pressures, interruptions, shut downs, etc. are in accordance with their regulations and requirements.

- C. If the utility company requirements are at variance with these drawings and specifications, this Contractor shall include the utility company requirements in his work without additional cost to the Owner.
 - D. Obtain from Utility Company any additional charges for service of type, size and location called for. Include charges in bid to be paid by Contractor to appropriate party. Provide payment of these charges so as to allow logical progression of construction and avoid delay of completion.
 - E. Should cost above not be available prior to bid, submit with bid a letter signed by responsible Utility Company personnel stating that cost is not available. Prime Contractor shall submit letter with his bid to Owner. Cost will then be omitted from contract and become responsibility of Owner.
 - F. Furnish with shop drawings a signed document from each utility company describing location and type of service to be supplied and requirements for service. Document shall be signed by the appropriate responsible representative of the respective utility company.
- 1.4 WORK NOT INCLUDED:
- A. Finish painting of piping, ductwork or equipment.
 - B. Electrical wiring and conduits shown on the electrical drawings.
 - C. Asbestos removal.
- 1.5 RELATED WORK SPECIFIED ELSEWHERE:
- A. Electrical: Division 26.
- 1.6 REQUIREMENTS OF REGULATORY AGENCIES:
- A. Obtain and pay for all permits required for the work. Comply with all ordinances pertaining to work described herein.
 - B. Install the work under this Division in accordance with drawings and specifications and the standards and codes (latest edition) that apply to this work. In the event of a conflict, install work in accordance with the most stringent code requirements determined by Architect.
 - C. Arrange, pay for and complete work to pass required tests by agencies having authority over work. Deliver to Architect Certificates of Inspection and approval issued by authorities.
- 1.7 QUALIFICATION OF CONTRACTOR:
- A. Has completed minimum two projects same size scope in past five (5) years.
 - B. This qualification applies to Sub-Contractors.
 - C. Use workmen experienced in their respective trade. Submit qualifications of Superintendent for review.
 - D. Owner reserves right to reject bid of any Contractor failing to meet these qualifications.

1.8 GENERAL JOB REQUIREMENTS:

- A. Drawings and Specifications:
1. Work for the mechanical trades are shown on the drawings series M (HVAC) and P (Plumbing).
 2. Drawings and specifications are complementary. Work called for by one is binding as if called for by both.
 3. Drawings are drawn to a small scale and are diagrammatic only. The drawings indicate size and general arrangement of equipment.
 4. Do not scale drawings for exact locations. Refer to architectural drawings. Field measurements take precedence.
- B. Provide necessary offsets, elbows and fittings as required to avoid conflict with equipment of other Divisions and to obtain proper headroom and clear passageways. This shall be done at no additional cost to the Owner.
- C. Visit to Site/Work in other Division:
1. Examine not only the plans and specifications for this Division, but plans and specifications of the other Divisions of work and visit the site to become acquainted with existing conditions. Execution of Contract is evidence that Contractor has examined all drawings and specifications, and that all conditions which have a bearing in any way on the manner of installing the work in this Division are known. Later claims for labor and materials required due to difficulties encountered, which could have been foreseen had examination been made, will not be recognized.
- D. Definitions:
1. Concealed: Materials or systems not visible. Work installed above a ceiling, furred behind a wall or enclosed in a chase.
 2. Exposed: Materials or systems that are visible. Work installed in a room without a ceiling. Work not enclosed by walls.
 3. Provide: Furnish, install and make complete.
 4. Install: Set in place and make connections.
 5. Work: Materials completely installed and connected.
 6. ADC: Air Diffusion Council.
 7. AGA: American Gas Association.
 8. AMCA: Air Movement and Control Association.
 9. ANSI: American National Standard Institute.
 10. API: American Petroleum Institute.
 11. ARI: American Refrigeration Institute.
 12. ASHRAE: American Society of Heating, Refrigerating and Air Conditioning Engineers.
 13. ASME: American Society of Mechanical Engineers.
 14. ASTM: American Society of Testing Materials.
 15. AWS: American Welding Society.
 16. FM: Association of Factory Mutual Fire Insurance Company.
 17. MSS: Manufacturer's Standard Society of the Valve and Fittings Industry, Inc.
 18. NEC: National Electrical Code.
 19. NEMA: National Electrical Manufacturer's Association.
 20. NFPA: National Fire Protection Association.
 21. NRCA: National Roofing Contractors Association.
 22. NSF: National Sanitation Foundation.
 23. OSHA: Occupational Safety and Health Act.
 24. PDI: Plumbing Drainage Institute.
 25. PFMA: Power Fan Manufacturers Association.
 26. SMACNA: Sheet Metal and Air Conditioning Contractors National Association.
 27. Standard: Building Code, Gas Code, Mechanical Code, Plumbing Code.

28. UL: Underwriters Laboratories.

E. Workmanship, Warranty and Acceptance:

1. Work under this Division shall be first class with emphasis on neatness and workmanship.
2. Install work using competent mechanics, under supervision of foreman, all duly certified by local authorities. Installation subject to Architect's constant observation, final approval, and acceptance. Architect may reject unsuitable work.
3. Furnish Architect written warranty, stating that if workmanship and/or materials executed under this Division is proven defective within one (1) year after final acceptance, such defects and other work damaged will be repaired and/or replaced.
4. In event that project is occupied or system placed in operation in several phases at Owner's request, warranty will begin on date each system or item of equipment is accepted by Owner.

F. Observations of Work and Demonstration of Operation:

1. When observations are scheduled, provide sufficient personnel to expedite removal of access doors, coverplates, manholes covers, etc.
2. Contractor to assist Architect in demonstration of operation of new systems to satisfaction of Owner. Contractor to have manpower available for demonstration of systems where requested by Owner.

G. Materials and Substitutions:

1. All materials shall be new. All materials and equipment for which a UL Standard, an AGA approval, an AWWA standard, FM listing or ASME requirements is established, shall be so approved and labeled or stamped.
2. Wherever in these specifications products are specified by manufacturer's name, bids shall be based on the named products. Where more than one manufacturer's name is mentioned, the one first listed establishes the standard for that product. If the bidder desires to submit a product of a manufacturer other than that listed first, it must be the equivalent of the one listed first.
3. The drawings are based on the use of products specified and listed first. If any revision is piping, conduit work, foundations, anchor bolts, connections, etc., is required by other named products or approved substitutions, it shall be the Contractor's responsibility to make such revisions at no additional expense to the Owner.
4. If any bidder desires to submit products of manufacturers not listed, he may submit a request for prior approval to the Engineer no later than 10 days prior to the bid date. If the Engineer decides to accept the manufacturers, they will be listed as "Approved" by written addendum.
5. If the manufacturers are not listed as approved either by addendum or in the specifications, they will not be accepted.
6. Submit to Architect within 28 days after award of contract a complete list of proposed material manufacturers. List does not preclude submission of shop drawings. Approval of manufacturer or list does not constitute approval of specific material or equipment.

H. Shop and Erection Drawings:

1. Submit shop drawings for materials and equipment furnished under Division 23 of specifications, to Architect for review within 30 days after award of contract. Shop drawings shall be submitted on a timely basis to allow adequate lead time for review, resubmission if necessary, manufacture and delivery to allow access of material to project at correct time based on schedule established by Architect/Contractor. On each shop drawing include the specification section that applies to that submittal. Include complete descriptive data with dimensions, operating data and weight for each item of equipment. Carefully examine shop drawings to assure compliance with drawings and specifications prior to submittal to Architect. Shop drawings and submittals shall bear the stamp of approval of the Contractor as evidence that the drawings have been checked by

him. Drawing submitted without this stamp of approval will not be considered and will be returned for proper resubmission.

2. Drawings larger than 8-1/2" x 11", submit three (3) copies and one (1) reproducible of each drawing. Architect will retain two (2) copies and return one (1) reproduction and one (1) copy to Contractor. Contractor is responsible for copying reproducible for distribution.
3. 8-1/2" x 11" drawings in brochure: Submit six (6) original copies for review Architect will retain two (2) copies and return four (4) copies to Contractor. Division 1 "General Conditions" take precedence over this specification.
4. Review of shop drawings does not relieve Contractor of responsibility for errors and omissions in shop drawings.
5. Contractor is responsible for dimensions and sizes of equipment. Inform Architect in writing of equipment differing from that shown.
6. Prepare erection drawings when required by Architect. Investigate thoroughly all conditions affecting work and indicate on drawing. Architect will review erection drawings before work commences.
7. Coordination shop drawings shall be prepared for the entire project. Refer to Division 1 for coordination drawing requirements.

I. Operating and Maintenance Manuals:

1. Provide maintenance and operating manuals bound in 8-1/2" x 11" hardback, three-post binders. Manuals shall contain written instructions for each system, shop drawings, schematic drawings, equipment catalog cuts, manufacturer's instructions, manufacturer's warranties, and valve tag list.
2. Arrange information in the following sequence: title of job, Owner, address, date of submittal, name of Contractor, name of Engineer, index, shop drawings, operating instruction, Contractor's purchase order numbers, supplier's name and address, date of startup of each piece of equipment and valve tag list.
3. Submit one (1) copy for review. Make required corrections, and submit two (2) record copies.

J. "Record" Blue Line Prints:

1. Provide "Record" blue line prints at the completion of job. One complete set of blue line prints will be furnished to the Contractor for record drawings. Keep set of prints on job and record day to day changes to Contract drawings with red pencil. Indicate actual location of piping, ductwork, valves, dampers, and equipment. Turn over prints to Architect at final observation.

K. Items for Owner: Provide the following items for Owner at time of substantial completion.

1. Certificates of inspection and approval from authorities having jurisdiction.
2. Warranties.
3. "Record" blue line prints.
4. Operating and Maintenance Manuals (3 copies).
5. Spare Parts (furnish receipt).
6. Affidavit of Owner Instruction (1 copy).

1.9 PROTECTION AND STORAGE:

- A. Provide warning lights, bracing, shoring, rails, guards and covers necessary to prevent damage or injury.
- B. Protect all equipment and materials, from damage by weather, entrance of water or dirt. Cap open piping; use plastic covers made for that purpose; do not use rags or construction debris.
- C. Avoid damage to materials and equipment in place. Repair, or remove and replace damaged work and materials.

- D. Protect all surfaces from weld spatter, solder and cutting oil.
- E. Deliver equipment and materials to job site in original, unopened, labeled container. Store to prevent damage and injury. Store ferrous materials to prevent rusting. Store finished materials and equipment to prevent staining and discoloring. Store materials affected by condensation in warm dry areas. Provide heaters. Storage space on site and in building designated by Owner/Architect.

END OF SECTION 230500

SECTION 230501 - COORDINATION

PART 1 - GENERAL

1.1 DRAWINGS FOR MECHANICAL AND ELECTRICAL WORK

- A. Drawings contain diagrammatic layouts and indicate general arrangement of systems, piping conduit, etc.
- B. Prior to installation of material and equipment, review and coordinate work with Architectural and Structural Drawings and other Division work for exact space conditions; where not readily discernable request information from Architect before proceeding.
- C. Check Drawings of all other trades to verify extent of material and equipment to be installed in spaces available and consider layout alternatives so that all requirements can be accommodated.
- D. Maintain maximum headroom at all locations without finished ceilings.
- E. Maintain finished ceiling heights as indicated on Architectural reflected ceiling plans, and building sections and elevation drawings.
- F. Coordinate installations with other trades prior to proceeding to prevent conflict with work of other trades and cooperate in making reasonable modifications in layout as needed.
- G. Where conflicts occur with placement of mechanical and electrical materials as they relate to placement of other building materials, the Architect shall be consulted for assistance in coordination of the available space to accommodate all trades.
- H. Coordinate equipment installation to maintain manufacturer and code required working clearances

1.2 PRIORITY OF CONSTRUCTION SPACE

- A. Following is the Order of Priority for Construction Space:
 - 1. First: Ductwork.
 - 2. Second: Fire protection piping.
 - 3. Third: Other piping.
 - 4. Fourth: Conduit.

1.3 COORDINATION DRAWINGS

- A. The Contractor shall prepare a complete set of "Cronoflex Mylar" type background drawings at scale of minimum 1/4" equals 1'-0".
 - 1. The construction documents in their original, copies or electronic file form are the Architect's instrument of service and are protected under copyright laws. The reproduction of these documents for use as coordination drawings or shop drawings is prohibited without the Architect's written consent and authorization.
- B. Each specialty trade listed below shall prepare a coordination Mylar overlay indicating his work, with appropriate elevations and grid dimensions.
- C. Each specialty trade shall sign and date the coordination drawing after the addition of his information.

- D. Fabrication shall not start until receipt of completed coordination drawings is acknowledged by the Contractor in writing to the Architect.
- E. Specialty Trades:
 - 1. Ductwork
 - 2. Fire protection piping
 - 3. Other piping
 - 4. Electrical
 - 5. Plumbing piping to include but not limited to sanitary, vent, pressure storm, medical gas (if provided), compressed air, natural gas, etc.
- F. Coordination Drawings required for all mechanical rooms, electrical rooms, equipment rooms, corridors, horizontal exits from duct shafts, cross overs and any other areas where congestion of work may occur.
- G. Coordination Schedule Drawing:
 - 1. The mechanical and plumbing contractor shall furnish to electrical contractor for coordination a schedule drawing providing all the electrical characteristics of all mechanical and plumbing equipment requiring electrical connection. The information provided shall include:
 - a. Unit Designation
 - b. Voltage
 - c. MCA
 - d. MOCP/MFS
 - e. FLA
 - f. Disconnect Requirement
 - g. Starter Requirement
 - h. Alarm Wiring Requirements
 - 2. The coordination schedule drawing, once received by the electrical contractor, shall be reviewed and all pertinent electrical accommodations indicated.
 - a. Breaker size.
 - b. Wire size / conduit size.
 - c. Disconnect with fuse size.
 - 3. Once the coordination schedule is completed forward to the engineers for review and approval.
- H. Any deviation in the mechanical equipment which results in a change in the electrical scope of work shall be the responsibility of the mechanical contractor. The mechanical contractor shall reimburse the electrical contractor for any cost. No added cost to the owner will be allowed.
- I. Conflicts that arise due to the fact that the coordination schedule drawing was not completed shall be the sole responsibility of the contractors. All costs for correction or remedial work shall be done at the contractor's expense. No added cost to the owner will be allowed.

END OF SECTION 230501

SECTION 230502 - BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 GENERAL

- A. Provide equipment, labor, materials, etc. required to make a complete working installation as shown or as specified.

1.2 PRODUCT DELIVERY, STORAGE AND HANDLING:

- A. Store materials on site in enclosures or under protective coverings.
- B. Do not store materials directly on the ground. Keep inside of materials free of dirt and debris.

1.3 CODES AND STANDARDS:

- A. Clean Air Act 1990
- B. Refrigeration Service Engineers Society

1.4 SUBMITTALS:

- A. Provide submittals for access panels, firestopping, sound stopping, roof mounting curbs, pipe supports, pipe identification, valve tags and charts.

PART 2 - PRODUCTS

2.1 ACCESS PANELS:

- A. Access panels shall have welded steel frame, one piece doors, and self latching door locks.
- B. Panels shall be Milcor, CESCO, Karp or prior approved equal. Milcor model numbers are cited as examples.

<u>Construction or Material</u>	<u>Model No.</u>
Surface	
Fire rated walls or ceiling	Fire Rated-Primer
1-1/2 Hr, B-Label	Finish
16 ga frame, 20 ga door	
Drywall walls and ceilings	DW primer finish
16 ga frame, 14 ga door panel	
Plaster walls and ceilings	K - primer finish
16 ga frame, 14 ga door	
Masonry and Tile	M - primer finish
	MS - stainless steel

- C. Locks: Standard locks shall be screw driver operated with case hardened steel cam.

2.2 FIRESTOPPING AND SOUNDSTOPPING:

- A. Firestopping materials shall conform to ASTM E 814.
 - 1. Penetration Sealants:
 - 2. Flame Stop Distribution, Inc., Flame Stop V.
 - 3. 3M Brand "Fire Barrier" CP 25 WB Caulk
 - 4. 3M Brand Moldable Putty "Pads" and Moldable Putty MPS-2 "Stix"

- B. Intumescent Sealants for use in openings and sleeves involving plastic pipe, insulated pipe or flexible cable:
 - 1. Flame Stop Distribution, Inc. Flame Stop VP with Retaining Fixture.
 - 2. 3M Brand "Fire Barrier" Caulk, with FS-195 Wrap Strip and CS-195 Composite Sheet.
- C. Sound stopping material shall be .75 lb per cu. ft. density fiberglass.
- D. Other acceptable manufacturers include GE "Pensil", Dow Corning, and Hilti.

2.3 MISCELLANEOUS STEEL:

- A. ASTM A-36 Structural Steel

2.4 PIPE IDENTIFICATION:

- A. Identification shall be in accordance with ANSI-A13.1. Pipe markers shall be Brady B-946 or Seton's Weather-Code.

2.5 EQUIPMENT IDENTIFICATION:

- A. Provide 3 1/2" x 2" engraved melamine nameplate on all HVAC and plumbing equipment. Plate shall be white with black engraved letter.

2.6 PIPE SLEEVES:

- A. Sleeves in concrete walls, floor and masonry - Sch 40 steel pipe, machine cut.
- B. Sleeves in gypsum board or plaster walls - 14 gauge, rolled galvanized sheet metal. Tack welded on the longitudinal seam.

2.7 WALL AND CEILING PLATES:

- A. Beaton and Cadwell or Keeney or Grinnell, nickel plated steel, split plates with set screw.

PART 3 - EXECUTION

3.1 ACCESS PANELS:

- A. Provide access panels in walls and ceilings as needed to allow access to valves, equipment, shock absorbers, trap primers, etc. and where noted.
- B. Access doors shall be selected for the type of wall or ceiling where needed. All locking access panels shall be keyed alike.

3.2 FIRE STOPPING AND SOUND STOPPING:

- A. Provide penetrations for piping through floors and walls for work under this contract. Penetrations through floors and fire resistant walls shall be sealed to the rated fire resistance equal to the wall. Installation shall be done by a qualified installer, approved by the manufacturer. Provide sound proofing through non-rated walls.

3.3 CUTTING AND PATCHING:

- A. Cutting and patching shall be done by General Contractor, but shall be paid for by this Contractor. This Contractor shall determine the extent of cutting and patching required under his Division and shall coordinate with the General Contractor prior to bid date.
- B. Cut walls, floors, ceilings, partitions, etc., required for the installation of this work in a neat and careful manner. Core drill for pipe sleeves and other openings through floors and walls. Sawcut larger openings. Cutting shall be kept to a minimum. Obtain approval of Architect before cutting or drilling.
- C. Replace or repair ductwork, conduit, piping, etc., that is cut.
- D. Patch around opening cut by this Contractor or provided by others for him. Patching shall be done by an approved qualified contractor, but shall be paid for by this Contractor. Finished patching shall retain fire and smoke ratings of the assembly and shall match surrounding finish.

3.4 EXCAVATION, SHORING AND BACKFILL:

- A. Provide any excavation required for work in this Division.
- B. Provide separate trench for each utility.
- C. Provide bracing, shoring, sheetpiling to protect sides of excavation, workers and adjacent structures. Provide site de-watering systems where water level is above bottom of trench.
- D. Provide barricades and lights to protect open excavations.
- E. Remove all timber and foreign material from excavation before backfilling. Backfill simultaneously on both sides of tanks, piping, etc. Backfill materials shall be approved clay or chert, free of debris, rock larger than 1-1/2 inch or other harmful material.
- F. Backfilling shall be done in 12 in. lifts or layers. All backfilling shall be compacted to the Modified Proctor Density (ASTM D-1557) listed below:

<u>90 Percent</u> Under sidewalks Grassed areas	<u>95 Percent</u> Paved areas Under structures Building slabs
- G. Restore existing pavement, curbs, sidewalks, sodding, etc. removed or damaged by work in this Division.
- H. Repair any settlement exceeding 1 inch that occurs within one year of acceptance of work.

3.5 ANCHORS:

- A. Mount all equipment, brackets, hangers, anchors, etc. to safely resist the vibration or thrust forces and support the unit's weight.
- B. Floor mounted rotating or vibrating equipment shall be anchored to the floor using grouted-in-place or cast-in-place anchor bolts with three inch hook and sleeve. Anchor bolts shall be of the size recommended by the manufacturer.
- C. Floor mounted static items, wall and ceiling mounted equipment bracket and hangers shall be installed using drilled anchors. Anchors shall be Phillips Drill Company "Red Head" or Multi-Set II. Size anchors and inserts for four times the applied load. Bolts used outdoors or in a wet environment shall be hot dip galvanized.

3.6 CLEANING AND PAINTING:

A. Pipe Sleeves:

1. Provide pipe sleeves where pipes pass through floors and walls above or below ceilings. Provide pipe sleeves in new walls and floors as the work progresses. Provide split pipe sleeves in new walls built up around existing pipes. Tack weld split sleeves together.
2. Size pipe sleeves to allow continuous insulation, but not less than two pipe sizes larger than pipe.
3. Sleeves in walls shall be flush with wall; sleeves in floors shall extend 3/4 inches above floor and be flush with structure below.

3.7 SOUND LEVELS:

- A. Select diffusers, grilles, and equipment so as not to exceed the NC curve rating for the various areas. Equipment and materials furnished shall be rated in accordance with the sound power tests measured in accordance with ASHRAE Standard 36B-63. Room attenuation and ceiling transmission loss shall depend on the spaces and architectural finishes.

B. Attenuation allowances shall be as follows:

Acoustical tile	-4dB
Plaster ceiling	-1dB
5/8 in. gypsum ceiling	-1dB
Room attenuation effect	-8dB

- C. Air performance tests shall be conducted in accordance with Air Diffusion Council (ADC) Equipment Test Code 1062 RI and ratings approved by the ADC.

D. Maximum sound pressure levels for installed material and equipment shall be as follows:

<u>Area</u>	<u>NC Curve Range</u>
Entire Building	25 - 40

3.8 WALLS AND FLOOR PLATES:

- A. Provide plates around pipes extending into exposed areas where they pass through walls, floors and ceilings. Size plates to completely cover pipe sleeves.

3.9 FLASHING:

- A. Provide flashing at piping and duct penetrations through roof and roof mounted structures furnished under this Division. Flash in accordance with roofing manufacturers details.
- B. Flashing materials shall be in accordance with the roofing manufacturers system.
- C. Provide flashing at pipes passing through floors with waterproof membrane. Flashing shall be in accordance with waterproofing manufacturer's details.

3.10 ROOF TOP WORK:

- A. Protect roof surface by using plywood walkouts, work platforms and cribbing during construction.
- B. Provide counterflashing unless specifically included in the work of another Division. Counterflashing shall be in accordance with roof manufacturer's instructions such that roof warranty is maintained.

- C. Provide a certificate of inspection from the roof manufacturer stating that the roof has been repaired in accordance with their specifications and that the warranty remains in effect.

3.11 PIPE IDENTIFICATION:

- A. Provide pipe markers and directional arrows on pipes at both sides of partitions and at floors slabs, at branch line take-offs, at valves at intermediate intervals not in excess of 20 ft. and at connections to equipment.
- B. Tape color band identifying markers and arrows on each pipe, both insulated and bare pipes. Pipe markers and arrows shall be located where readily visible and on lower quadrants of overhead pipes.
- C. Submit schedule of pipe markers, with legend and background colors for approval by the Architect.

3.12 EQUIPMENT IDENTIFICATION:

- A. Stencil on the equipment the functional name and equipment number of each piece of equipment as it is scheduled, i.e. pumps, fans, air handling units, etc.
- B. Stencil letters shall be black 1 in. high, located on a white background.

3.13 REFRIGERANT RECOVERY:

- A. All work on refrigerant systems shall employ service techniques that prevent release of refrigerants to the atmosphere.
- B. Remove all refrigerant. Place refrigerant in DOT approved containers for recycling/re-use.

3.14 WORKMANSHIP:

- A. Pipe size changes shall be made at reducing fittings. Bushings shall not be used.
- B. Provide drain valves at points where water is trapped in piping.
- C. Install pipe to prevent noise or water hammer.
- D. Blowout or flushout all lines prior to final connection or start-up, to remove foreign matter.
- E. Make allowance in piping for expansion and contraction, for installation of insulation and to avoid air pockets.
- F. Do not tap small pipes into larger pipes. Provide fittings or reinforced branch connections.
- G. Cut pipes ends square, ream and de-burr. Cut threads clean and sharp. Pipe threads shall conform to ANSI B 2.1.
- H. Pull up threaded fittings to a tight fit with an approved good quality pipe joint compound applied to male threads.
- I. Inspect screwed joints for leakage and remake each joint that appears to be faulty. Do not wait for rust to form. Clean threads on both parts apply compound and remake joints.
- J. Clean piping strainers after start-up by removing strainer screen and wire brushing.

- K. Conceal pipes in pipe shafts, partitions and furred spaces except where otherwise distinctly indicated on the drawings.
- L. Each riser shall be separately valved.
- M. Every branch pipe shall be controlled by a valve where it connects to the supply main or riser.
- N. Valves shall be easily accessible, with proper clearance for maintenance. Valves inside furred spaces, behind access doors shall be grouped to keep the number of access doors and their sizes to a minimum.
- O. Provide drain valves at the base of each riser.
- P. Provide drain valves and drain lines from pumps, heaters, water cooled equipment, relief valves, etc., and pipe to floor drains.
- Q. Tighten flanges and packing glands after the system has been placed in operation. Replace gaskets in flanges that show any signs of leakage after tightening.
- R. Install NO piping in electrical room, telephone rooms or electrical closets. Provide drip pans under drain piping above electrical switchgear in mechanical rooms.
- S. Install piping in alignment with and parallel to the walls of the building. All risers shall be plumb.
- T. No cross connections shall be installed between potable water systems and polluted supply or waste systems.
- U. Provide valves and unions or flanges at equipment such as pumps, coils, tanks, automatic valves, heat exchangers, etc. Provide valves on capped branches for extension by other contractors.
- V. Support piping at the proper intervals. Adjust pipe hangers and supports for correct pitch and alignment. Brace piping systems which sway.
- W. Remove rust, scale, and foreign materials from equipment and renew any defaced surfaces. If equipment is marred, provide new materials.
- X. Protect insulation. Repair insulation that is damaged. Keep it dry and free of tears. Allow no punctures in vapor barrier. Insure good tape adhesion. Provide smooth surfaces in finished areas.
- Y. Pitch sanitary lines: pipes 3 in. and larger not less than 1/8 inch per foot, pipes 2 inch and smaller not less than 1/4 inch per foot. Make changes in grade or direction by "Y" branches.
- Z. Pitch vent piping to free themselves of water and condensation. Install vent branches not less than 42 inches above floor.
- AA. Clean fixtures of labels and stains with whiting and alcohol. Clean copper tubing and fittings with steel wool to remove traces of oxidation.
- BB. Install ductwork to allow adequate clearance for maintenance. Locate fire dampers and access doors to allow replacement of fusible links. All dampers shall be accessible.

CC. All copper tubing shall be hard drawn, unless noted otherwise. Annealed tubing, where used, shall be stretched and installed with tool formed bends.

END OF SECTION 230502

SECTION 230510 - OWNER FURNISHED PRODUCTS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. This specification section covers the requirements of the mechanical contractor to receive, store, protect, insure and install all owner furnished equipment.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Mechanical General
- B. Refrigeration Piping System
- C. Power Ventilation
- D. Low Pressure Ductwork
- E. Temperature Controls (Elect.)

1.3 SUBMITTALS

- A. Submittals required.

PART 2 - PRODUCTS

- A. The following product listing describes the equipment types provided by the owner:
 - 1. One (1) 4 ton packaged, roof-top heat pump.
 - 2. One (1) 3 ton packaged, roof-top heat pump.
 - 3. Indoor thermostats and remote sensors.
 - 4. CO2 sensors and DCV controllers.
 - 5. Two position direct-coupled motorized dampers. Spring-return actuators not allowed.
 - 6. Backdraft dampers

PART 3 - EXECUTION

- A. General
 - 1. The mechanical contractor shall coordinate with owner, the shipping requirements to either the job site to the contractor's office.
 - 2. The mechanical contractor shall unload equipment/products and store and protect on site. Contractor shall also provide insurance for all stored material.
 - 3. The mechanical contractor shall install all equipment furnished by owner.
 - 4. The mechanical contractor shall provide all necessary appurtenances required for proper installation of equipment provided by owner as described in these specifications.
 - 5. The mechanical contractor shall provide all materials required to make connections between contractor-furnished and owner furnished equipment

END OF SECTION 230510

SECTION 230529 - SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. This specification describes the fabrication and installation requirements for equipment supports, pipe supports, pipe anchors, pipe guides and brackets.
- B. The work of this section is subject to the requirements of the Mechanical General Provisions.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

- A. Basic Materials and Methods
- B. Insulation
- C. Vibration Isolation
- D. Plumbing Piping

1.3 SUBMITTALS:

- A. Submittals shall include the following information and data:
 - 1. Manufacturer's Data Sheets on all catalog items to be used.
 - 2. Sketches covering all specially designed assemblies and fabrications.
 - 3. Sketches showing locations, loads, calculated travel, types and sizes of all spring hanger assemblies.
 - 4. Sketches covering all anchor and guide assemblies.

1.4 STANDARDS:

- A. Manufacturer's Standardization Society of the Valve and Fittings Industry, Inc.
- B. Standard SP-58 Pipe Hangers and Supports-Materials, Design and Manufacture
- C. Standard SP-69 Pipe Hangers and Supports-Selection and Application
- D. Standard SP-89 Pipe Hangers and Supports-Fabrication and Installation Practices.
- E. Standard SP-90 Guidelines on Terminology for Pipe Hangers and Supports
- F. ANSI/ASME B31 Codes for Pressure Piping
- G. ASME Boiler and Pressure Vessel Codes
- H. WW-H-171E Federal Specification, Hangers and Supports, Pipe
- I. AISC Manual for Steel Construction

PART 2 - PRODUCTS

- A. Hangers for suspending pipe 2-1/2 in. and larger shall be capable of vertical adjustment.
- B. Steel and malleable iron hangers sized for copper tubing shall be copper plated.

C. Pipe slides shall be fabricated to accommodate full thickness of insulation.

D. Hangers, devices and hardware located outdoors shall be hot dip galvanized.

Horizontal Pipe Attachments: (Cast Iron Pipe, Ductile Iron Pipe, Steel Pipe, FRP & PVC Pipe, and Copper Tubing larger than four inches) Type numbers as defined in MSS-SP-58

-- INDICATES NOT NORMALLY USED

X INDICATES ACCEPTABLE APPLICATION

NA INDICATES NON-ALLOWABLE

TYPE 1 - Adj. Steel Clevis Hanger; Grinnell B-Line	INSULATED Hot Lines X Note 1	UNINSULATED Ambient X	INSULATED Cold X	FIRE PROTECT UL LISTED	UNINSULATED PLUMBING X
TYPE 3 - Double Bolt Pipe Clamp	NA	X	NA	X	X
TYPE 4 - Steel Pipe Clamp	NA	X	NA	X	X
TYPE 5 - Pipe Hanger, TYPE 10 - Adj Swivel ring Band Type	NA	NA	NA	NA	NA
TYPE 36 - Pipe Saddle Support	X Note 1	X	X Note 1	NA	X
TYPE 37 - Pipe Stanchion Saddle	X Note 1	X	X Note 1	NA	X
TYPE 38 - Adj. Pipe Saddle Support	X Note 1	X	X Note 1	NA	X
TYPE 41 - Single Pipe Roll	X Note 3	--	X Note 1	--	--
TYPE 43 - Adj. Roller Hanger w/ Swivel	X Note 3	--	--	--	--
TYPE 44 - Pipe Roll Complete	X Note 3	--	--	--	--
TYPE 45 - Pipe Roll & Plate	X Note 3	--	--	--	--
TYPE 46 - Adj. Pipe Roll & Base	X Note 3	--	--	--	--

NOTE:

1. Hangers on insulated piping systems shall incorporate protection saddles or shields.
2. The design shall be in accordance with MSS SP-58.
3. For shields used with rollers or subject to point loading, see table for Type 40 shields (MSS SP-58).
4. Continuous inserts, anchor bolts and concrete fasteners may be used as specified by the Engineer.

Vertical Pipe Attachments/Hanger Rod Fixtures
Type numbers as defined in MSS-SP-58

	(Insulated); Hot Lines - 120 - 240°F	Ambient 60 120°F	(Insulated); Cold Line - 59° and below	Fire Protection - (U.L. Listed)	(Uninsulated) Plumbing
Type 8 - up to and incl. 8" pipe riser clamp grinnel B-line	X	X	X	X	X

- E. MISCELLANEOUS:
1. Hanger Rod - ASTM-A36 or A 575 Threaded Hot Rolled Steel
 2. Upper Attachments

<u>Item MSS SP 69</u>	<u>TYPE NO.</u>
Side Beam or Channel Clamp	20
Center Beam	21
Welded Beam Attachment	22
C-Clamp	23
Top Beam Clamp	25
Side Beam Clamp	27
Steel Beam Clamp W/Eye Nut	28
Linked Steel Clamp W/Eye Nut	29
Welded Steel Bracket	31, 32, 33
Side Beam Bracket	34

PART 3 - EXECUTION

3.1 GENERAL:

- A. Drill for anchors in structural slabs and walls. Anchors shall be Phillips Drill Company "Red Head", or Multi-Set II. Hilti Fasteners, Rawplug Company and Wej-it Corporation are approved equals. Powder actuated fasteners are prohibited.
- B. Support piping independent of pumps, adjacent piping and equipment.
- C. Structural supports shall be designed in accordance with AISC - Manual for Steel Construction. Support from the floor all horizontal piping with a centerline elevation less than four feet from the floor.

3.2 STRUCTURAL STEEL:

- A. All structural steel components used in the fabrication of supports, guides, etc. shall be ASTM A-36 or ASTM A 500 Grade A or B structural steel.
- B. All steel framing, weldments and miscellaneous steel necessary for the installation of supports, guides, anchors, etc. shall be designed in accordance with the AISC Steel Handbook. Steel shall be shop fabricated, furnished by the contractor. Steel shall receive one shop coat of primer.
- C. Attach wall mounted pipe supports for exposed piping on dry wall construction to angle or channel supports framed into wall studs.
- D. Support exposed piping on walls with split cast iron pipe holders.
- E. Supports, guides, and anchors shall be so designed that excessive heat will not be transmitted to the building steel. The temperature of supporting parts shall be based on a temperature gradient of 100 degrees F per inch distance from the outside surface of the pipe. Temperature at point of contact to the building structure shall be 100 degrees F.
- F. Support piping systems by using standards manufactured hangers and supports wherever possible.
- G. All pipe hangers and supports shall allow for the expansion and contraction of the piping systems.

3.3 VERTICAL:

- A. Support vertical pipe at base and at each floor. In addition, 1 inch or smaller copper pipe shall be supported at 5 foot intervals.
- B. Support sanitary risers at bases on masonry or cast-in-place concrete piers.
- C. Pipe support attachments to the riser piping shall be riser clamp lugs. Welded attachments shall be of material comparable to that of the pipe, and designed in accordance with governing codes.
- D. Support hubless and bell and spigot cast iron at every length near fitting. Where maintenance requirements may impose torque, as at a cleanout, support on both sides of torque point.
- E. Support vertical pipe independently of connected horizontal pipe. Use riser clamps which extend beyond the insulation to support the weight of the pipe.

3.4 HORIZONTAL:

- A. Use wall brackets to suspend or support pipe runs near walls. Hanger rods shall be used in tension only. Install rods plumb, limit rod travel to 4 degrees from vertical.
- B. Multiple adjacent pipes at the same bottom-of-pipe elevation may be supported from Unistrut, Kindorf or B-Line channel trapeze hanger.
- C. Cold systems (Fluid temperatures below 59 degrees F):
- D. Install pipe hangers and supports with insulation protection shield. Hangers and supports must be sized to fit the outside diameter of the pipe insulation.
- E. Hot Systems (Fluid temperatures 140 degrees F and higher): Install pipe hangers with insulation protection shield on lines with minimal thermal growth (less than 1 in.).
- F. Install pipe covering protection saddles on line with longitudinal thermal growth exceeding 1 in. Use traveling hanging devices for suspended lines and slides, rollers or roller carriages for pipes supported from below. All devices must be sized to fit the outside diameter of the pipe insulation.

SUPPORT SPACING: HORIZONTAL PIPING SUPPORT SCHEDULE (Carbon Steel and Copper)

NOMINAL PIPE SIZE TUBING O.D.	SUPPORT SPACING FT.	ROD SIZE IN	SUPPORT SPACING FT	ROD SIZE IN	SUPPORT SPACING FT	ROD SIZE IN	SUPPORT SPACING FT	ROD SPACING IN	SUPPORT SPACING FT**	ROD SIZE IN
Up to 1/2	7	3/8	5	3/8	--	--	3-1/2	3/8	--	--
3/4	7	3/8	6	3/8	--	--	4	3/8	--	--
1-1/4	7	3/8	7	3/8	--	--	5	3/8	--	--
1-1/2	8	3/8	8	3/8	--	--	5	3/8	--	--
2	10	3/8	8	3/8	*	3/8	5	3/8	--	--
2-1/2	11	1/2	9	1/2	*	3/8	6	1/2	--	--
3	12	1/2	10	1/2	*	1/2	6	1/2	--	--
4	14	5/8	12	1/2	*	1/2	6-1/2	1/2	14	5/8
6	17	3/4	--	--	*	1/2	7-1/2	5/8	17	3/4
										1-1/4
										1-1/4

* REFER TO PARAGRAPH "HORIZONTAL PIPE SUPPORTS: CAST IRON" FOR SPACING OF SUPPORT

** 20 FT. MAX SPACING: MIN OF ONE (1) HANGER PER PIPE SECTION CLOSE TO THE JOINT BEHIND THE BELL AND AT CHANGE OF DIRECTIONS AND BRANCH CONNECTIONS.

3.5 HORIZONTAL PIPE SUPPORT: CAST IRON:

- A. Support horizontal cast iron pipe with hanger, or pier, located close to the hub; use one support for each pipe length, or every other joint, whichever is closer.
- B. Provide hanger within 18 inches of each elbow, also provide hanger within 18 inches of connection to each piece of equipment.
- C. Support hubless and bell and spigot cast iron at every length near fitting or clamp. Where maintenance requirements may impose torque, as at a clearance, support on both sides of torque point.

END OF SECTION 230529

SECTION 230549 - VIBRATION ISOLATION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. The work included in this specification consists of furnishing all labor, materials, accessories and equipment necessary to the isolate all vibrating or rotating equipment from the building structure.
- B. The work of this section is subject to the requirements of the Mechanical General Section – Division 23.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

- A. Basic Materials and Methods
- B. Plumbing Equipment
- C. Power Ventilators

1.3 SUBMITTALS:

- A. Submit for each type and size of vibration isolator the spring outside diameter, deflection, operating spring height, solid spring height, and the ratio of the outside diameter to the spring height.
- B. Submit shop drawings and design calculations for platforms, rails, and saddles prepared either by the machinery manufacturer for the recommended machinery mounting or by the vibration isolation equipment manufacturer. Drawings shall include isolator, seismic snubber, and anchor bolt layouts, sizes, specifications. Calculations shall show that the maximum stresses in any steel base, rail or saddle, will not exceed 18,000 psi during machinery operation.

1.4 QUALITY ASSURANCE:

- A. Vibration isolation devices, including auxiliary steel bases and pouring forms, shall be designed and furnished by a single manufacturer or supplier.
- B. Vibration isolation efficiency shall be not less than 95 percent. Deflection shall be not less than that listed on the drawings.
- C. Manufacturers:
 - 1. Amber Booth, Mason Industries, or Peabody Noise Control.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All spring isolators shall be completely stable in operation and shall be designed for not less than 50 percent reserve deflection beyond actual operating conditions. Open spring isolators shall be designed such that the Kx/Ky ratio shall be 1.0 or greater for stability.
- B. The outside diameter of the spring shall be no less than 80 percent of the operating height of the spring.

- C. All elastomeric isolators shall be of neoprene or high quality synthetic rubber with anti-ozone and anti-oxidant additives.
- D. Steel components shall be cleaned and painted. All nuts, bolts and washers shall be zinc-electroplated. Structural steel bases shall be thoroughly cleaned of welding slag and primed with zinc-chromate or metal etching primer.
- E. All isolators mounted outdoors or in wet areas shall have PVC or neoprene coated springs and hot dipped galvanized steel components. Aluminum components shall be etched and painted. Nuts, bolts and washers shall be stainless steel or galvanized steel.
- F. Isolators for equipment installed outdoors shall be designed to provide adequate restraint due to normal wind conditions and to withstand wind loads of 30lbs./sq. ft. applied to any exposed surface of the isolated equipment.
- G. All bases exposed to the weather shall be hot dipped galvanized after fabrication.
- H. Air handling equipment shall be furnished with isolating thrust resisters to limit displacement to 1/4 inch.
- I. Height saving brackets used with isolators having 2.5 inch deflection or greater shall be of the pre-compression type to limit exposed bolt length.

2.2 ISOLATORS:

- A. Isolators are identified by type in accordance with ASHRAE Handbook, 1995 HVAC Applications, Chapter 52 "Sound and Vibration Control"

2.3 TYPE 1:

- A. Rubber Pads (Support):
 - 1. Consisting of two layers of 3/8 inch thick ribbed or waffled neoprene pads bonded to a 16 gage galvanized steel separator plate. Pads shall be sized for approximately 20 to 40 psi load and a deflection of 0.12 inch to 0.16 inch.
- B. Glass Fiber Pads (Support):
 - 1. Pre-compressed molded fiberglass isolation pads, neoprene jacketed and stabilized during manufacturing. Pads shall be sized for loading from 40 to 60 psi.

2.4 TYPE 2:

- A. Rubber Mounts (Support):
 - 1. Molded neoprene mounting having a steel baseplate with mounting holes and a threaded insert at top of the mounting for attaching equipment. All metal parts shall be completely embedded in the elastomeric material. Mountings shall approximately 1/2-inch deflection.

2.5 TYPE 3:

- A. Open Spring Isolator (Support):
 - 1. An adjustable, free-standing, open-spring mounting with combination leveling and equipment fastening bolt. The spring shall be welded to the spring mounting baseplate and compression plate for stability. Neoprene pad having a minimum thickness of 1/4 inch shall be bonded to the baseplate.

- B. Open Spring Isolator (Hanger):
 - 1. A combination spring and elastomeric hanger consisting of a rectangular steel box capable of 200 percent minimum overload without visible deformation, coil spring, spring retainers, and elastomeric mounting designed approximately 1/2-inch deflection.

2.6 BASES:

- A. Type A - Direct Isolation:
 - 1. Framing or support supplied with equipment is unitary and rigid and does not require additional support.
- B. Type B - Structural Base: Not Used This Contract.
- C. Type B1 - Structural Rails: Not Used This Contract
- D. Type B2 - Structural Base: Not Used This Contract.
- E. Type C - Concrete Inertia: Not Used This Contract
- F. Type D - Curb Isolation: Not Used This Contract
- G. Type 6 - Spring Hanger:
 - 1. A spring hanger consisting of a rectangular steel box capable of 200 percent minimum overload without visible deformation. Hanger shall include: coil spring, spring retainers, Neoprene impregnated fabric washer, and steel washer.

PART 3 - EXECUTION

3.1 EQUIPMENT:

- A. Spring type vibration isolators shall be used for all equipment driven by motors of 3 HP and larger unless otherwise noted. Deflections as tabulated are minimums and it shall be the responsibility of the isolation manufacturer to determine the amount of spring deflection required for each isolator to achieve optimum performance, prevent the transmission of objectionable vibration and meet the noise criteria referenced herein.
- B. Equipment driven by motors 2 HP and smaller shall be isolated by means of Type 1 elastomeric mounts or Type 2 elastomeric hangers properly sized for 1/2 inch deflection unless otherwise noted.
- C. All motorized heating and air conditioning equipment, including pumps, fans and other equipment, shall be mounted on, or suspended with, vibration isolators.
- D. Unless otherwise indicated, all equipment shall be anchored by bolting to isolation base or isolator top plate. Isolator base plates shall be bolted to concrete floors or supporting structural steel.

3.2 FLEXIBLE CONNECTORS:

- A. Install full line size flexible pipe connectors at the suction and discharge of each pump and at the inlet and outlet of each condenser and chiller and where shown on the drawings. All connectors shall be suitable for use at the pressure and temperature encountered at the point of installation.

B. Refer to piping specifications for type of connections.

END OF SECTION 230549

SECTION 230700 - INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. The work included in this specification consists of providing all labor, materials, accessories and equipment necessary for the insulation of all piping and mechanical equipment.
- B. The work of this section is subject to the requirements of the Mechanical General Provisions.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

- A. Basic Materials and Methods Section
- B. Plumbing Piping
- C. Low Pressure Ductwork

1.3 DEFINITIONS:

- A. Exposed piping and ductwork is that which can be seen when the building is complete without opening or removing access door panels, or ceilings tiles. This also includes all mechanical equipment rooms and pipe tunnels.
- B. Concealed piping and ductwork are those elements above ceilings, in chases, interstitial space and pipe spaces.
- C. Other piping and ductwork is considered to be exposed.
- D. Exterior piping and ductwork is that which is exposed to the weather and/or exterior to the building envelope. Piping and ductwork protected by overhangs, areaways, etc., exterior to the building envelope are considered exterior.
- E. ASJ: All service jacket, white finish facing or jacket.
- F. Air conditioned space: Space directly supplied with heated or cooled air.
- G. Cold: Equipment, ductwork or piping handling media at design temperature of 60 degrees F or below.
- H. FSK: Foil-scrim-kraft facing.
- I. Hot: Ductwork handling air at design temperature above 60 degrees F; equipment or piping handling media above 105 degrees F.
- J. Pcf: Density, pounds per cubic foot.
- K. Runout: Branch pipe connection up to one inch nominal size to a floor mounted fan coil unit.
- L. Thermal conductance: Heat flow rate thru materials:
 - 1. Flat surface: BTU per hour per square foot.
 - 2. Pipe or cylinder: BTU per hour per linear foot.

- M. Thermal conductivity (k): BTU per inch thickness, per hour, per square foot, per degree Fahrenheit temperature difference.

1.4 QUALITY ASSURANCE:

- A. Products of the manufacturers, herein, will be acceptable for use for the specific functions noted. All materials shall be compatible with the materials to which they are applied, and shall not corrode, soften or otherwise attack such materials in either the wet or dry state.
- B. Materials shall be applied subject to their temperature limits. Any methods of application of insulation materials or finishes not specified in detail herein shall be in accordance with the particular manufacturer's published recommendations.
- C. Insulation shall be applied by experienced workers regularly employed for this type work.

1.5 RATING:

- A. All insulation shall have composite surface burning characteristic rating as tested by ASTM E 84, UL 723, or NFPA 255 not exceeding:
 - 1. Flame Spread 25
 - 2. Smoke Developed 50
- B. Composite shall include insulation, jacketing and adhesive used to secure jacketing or facing. All accessory items such as PVC Jacketing and Fittings, adhesive, mastic, cement, tape and cloth shall have the same component rating as specified above.

1.6 STANDARDS:

- A. Insulation shall be designed and installed in accordance with the Commercial and Industrial Insulation Standards of the Midwest Insulation Contractors Association, Third Edition.
- B. Insulation thickness, where specified herein, shall be equal to or greater than the guidelines presented in ASHRAE Standard 90.1 - 2004, Energy Conservation in New Buildings.

1.7 SUBMITTALS:

- A. Submittals shall include: catalog product literature on all insulation components, data showing compliance with flame spread and smoke development rating, manufacturers recommended installation data and material safety data sheets.

PART 2 - PRODUCTS

2.1 GLASS FIBER INSULATION:

- A. Piping:
 - 1. Nominal minimum thicknesses are listed in the table below. These thicknesses are based on insulation having a thermal resistivity between 4.0 to 4.6 sq. ft.-hr.-F/BTU-in. on a flat surface resistivity to maintain equivalent insulation value.
 - 2. Insulation shall be 850 deg. F rated as manufactured by Owens Corning, Manville, Knauf or Certainteed Corporation.
 - 3. Insulation shall have factory-applied, reinforced, flame retardant, vapor barrier jacket equal to Owens-Corning ASJ with self sealing lap. Butt joints shall be taped with field-applied ASJ tape 3 in. wide.
 - 4. Refer to the table at the end of this section for required pipe insulation thicknesses.
 - 5. Routed or molded fitting insulation shall be Hamfab.

- B. Ductwork:
1. Insulation shall be 250 deg. F rated as manufactured by Owens Corning, Manville, Knauf, or Certainteed.
 2. Concealed Duct Duct Wrap: 2 in. thick, 3/4 PCF with aluminum or FSK facing, having a maximum vapor transmission of .02 perms. Minimum installed "R" value shall be 6.0 with 25% compression.
 3. Exposed Rectangular Duct Insulation Board: 1-1/2 in. thick 6 PCF with FSK facing.
 4. Exposed Round Duct Commercial Ductwrap: 1-1/2 in. thick 3 PCF semi-rigid, flexible board type with all service jacket.

2.2 ELASTOMERIC CLOSED CELL INSULATION:

- A. Tubing and Sheet:
1. Flexible fire retardant closed cell, conforming to ASTM C 534, and ASTM 1056. Thermal resistivity shall be 3.70 sq. ft.-hr-F/BTU-in. Insulation shall be Aramacell, Rubatex or Armstrong.

2.3 ACOUSTICAL INSULATION:

- A. Acoustically treated metal jacketing shall be Childers Muffl-Jac, sound barrier jacketing.
- B. Acoustical lagging shall be Childers Muffl-Lag.
- C. Acoustical lining shall be a composite of an absorbing layer of acoustical grade foam, non-ferrous metal septum, and acoustical grade foam.
- D. Acoustical properties shall be measured in accordance with ASTM E90, STC classified in accordance with ASTM E413.
- | Frequency-Hertz | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 |
|-----------------------|-----|-----|-----|------|------|------|------|
| Transmission Loss dB, | 15 | 19 | 21 | 28 | 33 | 37 | 27 |
| 1 lb./sq. ft. septum | | | | | | | STC |
- E. Lining shall be United McGill FMF-P or FVF-P.
- F. Lining adhesives shall be United McGill.
1. Contact adhesive: United McGill Product No. ADH-CON2 Epoxy adhesive: United McGill Product No. ADH-EP-1 Urethane adhesive: United McGill Product No. ADH-UR-1

2.4 FINISHES:

- A. Rewettable glass cloth, 9 ounce per square yard, rated for 450 degrees F. Covering shall be J.P. Stevens, or Alpha Maritex.
- B. Metal jacketing, smooth .016 in. thick, type T 3003 aluminum with laminated moisture barrier. Jacketing shall be Childers, Aluminum Roll Jacketing with Polykraft Moisture Barrier.
- C. Metal fitting covers shall be two piece aluminum. Covers shall be Ell-Jac.
- D. Foil scrim kraft (FSK) jacket, flame retardant vapor barrier. Jacket shall be Alpha Temp 10651, all service jacket.
- E. Fitting covers shall be one piece 20 mil PVC, covers shall be Ceel-Tite 550 PVC-UVR by Ceel-Co. Zeston and Proto are approved equals.
- F. Water based latex enamel equal to Armstrong WB Armaflex Finish.

2.5 MISCELLANEOUS:

- A. Adhesives (Duct): Foster 85-20, Vimasco J545F.
- B. Vapor seal mastic: Childers CP-30 Low Odor, Foster 30-15.
- C. FSK tape 3 in. wide, equal to Nashua FSK.
- D. Insulpins.
- E. Roll on Corner bead (2 in. x 2 in., 26 ga. galvanized steel).
- F. Fiber reinforced tape - Nashua 357, or 398.
- G. Insulation protection shields - Grinnell fig 167.
- H. Rigid insulation inserts - Hamfab.
- I. Contact adhesive: Armstrong 520 or Rubatex R-373.
- J. Hydraulic Insulating Cement, conforming to ASTM C449.
- K. Vinyl Acrylic Weather Barrier Mastic: Vimasco WC-5, Childers VI-Cryl CP10/11.
- L. Reinforcing Cloth - Vimasco, Elastafab 894, conforming to ASTM D1668.
- M. Bands - .020 in., aluminum, 1/2 in. wide.
- N. Hexagonal Wire Netting - One inch mesh, 22 ga. galvanized steel.

PART 3 - EXECUTION

3.1 GENERAL:

- A. Insulation shall be applied to clean and dry surfaces after tests and approvals required by this specification have been completed.
- B. On cold surfaces where a vapor barrier must be maintained, insulation shall be applied with a continuous, unbroken moisture and vapor seal. All hangers, supports, anchors, or other projections that are secured to cold surfaces shall be insulated and vapor sealed to prevent condensation.
- C. All surface finished shall be extended in such a manner as to protect all raw edges, ends and surfaces of insulation.
- D. All pipe or duct insulation shall be continuous through walls, ceiling or floor openings, or sleeves; except where firestop or firesafing materials are required.
- E. Metal shields shall be installed between hangers or supports and the piping insulation. Rigid insulation inserts shall be installed as required between the pipe and the insulation shields. Inserts shall be of equal thickness to the adjacent insulation and shall be vapor sealed as required.
- F. Insulate valves, fittings, flanges etc. with the same thickness of insulation as specified for piping.

- G. Install longitudinal jacketing laps to shed rainwater.
- H. Insulate items mounted in ductwork with the same thickness of insulation as specified for ductwork: including air measuring stations, smoke dampers, and automatic dampers.
- I. Repair insulation damaged by work under this contract to match existing work or replace damaged portion with insulation specified for new work.
- J. Standing seams and other projections in ductwork or casings shall have insulation applied so that at least 1/2" of insulation will cover such projections.
- K. Where ductwork is lined, no thermal insulation is required.
- L. Where unlined duct and lined duct connect, the insulation shall overlap lined section at least 6".
- M. Piping and ductwork covered with metal or P.V.C. jacketing systems shall have the joints made to shed water. Laps shall be positioned in the bottom quadrant on horizontal pipe and ductwork.

3.2 CONCEALED DUCTWORK:

- A. Apply jacketed ductwrap to all concealed ductwork providing conditioned air, return air and outside air.
- B. Pull insulation snug, but do not compress insulation more than 1/4 inch.
- C. Secure ductwrap insulation to ductwork using adhesive. Secure insulation on bottom and sides of horizontal ductwork and all sides of vertical ductwork with insulpins welded to duct on 12 to 18 in. centers and with clips slipped over the pins. Apply clips without compressing insulation. Make joints by lapping the facing a minimum of 2 in., and stapling with T-5 flared staples. Vapor-seal with Childers CP-30 Low Odor at all staples, clip locations and other penetrations. Seal joints with 3 in. wide FSK tape.

3.3 EXPOSED DUCTWORK (RECTANGULAR):

- A. Apply insulation board with FSK facing to all exposed ductwork providing conditioned air, or outside air. Insulate return ductwork in non-conditioned spaces.
- B. Secure insulation with insulpins (all surfaces) welded to duct on 12 to 18 in. centers and with clips slipped over pins. Seams and joints shall be vapor sealed with 3 in. wide FSK tape. Corners and edges of ductwork shall be reinforced with roll-on corner bead.
- C. Seal all break and punctures with vapor barrier sealant and FSK tape.

3.4 EXPOSED DUCTWORK (ROUND):

- A. Apply commercial semi-rigid flexible board insulation with FSK facing to all exposed round or flat oval ductwork providing conditioned air or outside air.
- B. Secure insulation to ductwork using adhesive. Tightly butt insulation sections together. Longitudinal joint shall be lapped 2 in., stapled and taped. Tape circumferential joints with FSK tape at a 50 percent overlap. Tape entire girth at mid-point between joints.
- C. Secure insulation with pins on vertical ductwork and the bottom surface of flat oval ductwork. Pins shall be spaced on 12 to 18 in. centers with clips slipped over the pins.

3.5 IRREGULAR SURFACES:

- A. Apply one layer of 1 inch thick elastomeric closed cell sheet insulation with adhesive to the following.
- B. Miscellaneous:
 - 1. Waste piping from electric water coolers to drainage system.
 - 2. Cooling coil condensate piping.
- C. Apply one layer of 1" elastomeric closed cell tubular or ½-inch fiberglass insulation to cold domestic water piping.
- D. Domestic hot water piping 1 in. and smaller may be insulated with ¾ in. thick elastomeric closed cell insulation in lieu of fiberglass.
- E. Provide 1" thick insulation covers and caps for all valve stems and operators, gauge cocks, thermometer wells and other appurtenances subjects to sweating.
- F. Insulate fittings and valves with miter cut pieces for insulation same thickness as piping.

3.6 REFRIGERANT PIPING:

- A. Refrigerant Suction Lines and Hot Gas Bypass Lines: "ELASTOMERIC CLOSED CELL INSULATION ", 1" thick. Jacket piping located outdoors or exposed to view with aluminum jacket.
- B. AC Unit Drain Lines: "ELASTOMERIC CLOSED CELL INSULATION ", ¾" thick. Jacket piping exposed to view with aluminum jacket.

3.7 FINISHES:

- A. All insulated refrigerant piping installed outdoors and exposed indoor piping within 8 ft. of the finished floor shall be covered with .016 in. thick aluminum jacket, and held in place with 1/2 in. wide aluminum bands on 9 in. centers. Fittings shall be covered with mitered segments of jackets or two piece preformed fitting covers. Provide angle ring escutcheons at wall, ceiling or floor penetrations.
- B. Machine cut the jacket to produce a straight, smooth edge. Lap longitudinal and circumferential seams not less than 2 in. Install jackets on horizontal piping with the longitudinal seam approximately midway between horizontal centerline and the bottom side of pipe. Install with the top edge of jacket overlapping the bottom edge of jacket and with the seam of each jacket slightly offset from the seam of the adjacent jacket. Install jackets on vertical piping and on piping pitched from the horizontal from low point to high point so that the lower circumferential edge of each jacket overlaps the jacket below it.
- C. Concealed Piping finish covering shall be All Service Jacket. Fittings shall be covered by wrapping the fitting with fiber reinforced tape, with a 50 percent overlap.

END OF SECTION 230700

SECTION 230900 - TEMPERATURE CONTROLS (ELECTRIC)

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. The work included in this specification consists of furnishing all labor, material, accessories and equipment necessary for the temperature control system.
- B. The work of this section is subject to the requirements of the Mechanical General Provision.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

- A. Basic Materials and Methods

1.3 CODES AND STANDARDS:

- A. Furnish and install an electric system of automatic temperature control as specified herein and as shown on the Contract drawings as manufactured by equipment manufacturer.

1.4 SUBMITTALS:

- A. System documentation shall include the following:
 - 1. Manufacturer's data sheets of all products (original copies).
 - 2. Complete description of operation of all control loops, including recommended setpoints and ranges of adjustment.
 - 3. Fully labeled elementary diagram (electrical ladder diagram).
 - 4. Lists of all proposed devices and equipment.

PART 2 - PRODUCTS

2.1 ELECTRIC ACTUATORS:

- A. Motor Operators:
 - 1. Motor operator shall be spring return type, which returns motor actuator shaft to its full normal mechanical travel upon power failure. Damper motor drive mechanism will include holding brake to keep the return spring from drawing the actuator from driving toward its normal position unless power is interrupted.
 - 2. Motor actuator shall operate from a SPDT on/off control.
 - 3. Rotational travel shall be 45 degrees to 270 degrees.
 - 4. Voltage: 24 volts AC.
 - 5. Operating speed: 60 seconds for 160 degrees travel.
 - 6. Housing: die-cast aluminum.
 - 7. Unit shall be available with mounting brackets, shaft linkage assemblies, and end switches.
 - 8. Unit shall be Honeywell S0524 – 2 position direct coupled spring return actuator or prior approved equal.

2.2 AUTOMATIC DAMPERS:

- A. All control dampers shall be standard products of damper or temperature control manufacturer unless noted otherwise.
- B. Local fabrication of dampers is not allowed.
 - 1. Damper construction shall be as follows:
 - 2. Damper frames: 16 gauge galvanized steel.

3. Blades: Not over 6 inches wide nor less than 22 gauge galvanized steel roll formed, with stainless steel shafts.
4. Bearings: Nylon with ½-inch shafts.
5. Linkages: Galvanized steel, exposed type.
6. Side seals: Stainless steel of the tight-seal spring type.
7. Dampers and seals suitable for temperature ranges of -40 to 200 degrees F.
8. Dampers shall be opposed blade type, and the Contractor shall submit construction data for all control dampers with the temperature control submittal.

C. Dampers shall be Ruskin CD50.

2.3 TEMPERATURE CONTROL WIRING:

- A. All control wiring and conduit required to complete the temperature control system shall be installed by the Temperature Control Sub-Contractor in accordance with the Electrical Specifications Division 26.

2.4 DUCT-MOUNTED SMOKE DETECTORS:

- A. Duct Mounted Photoelectric Detectors: Dual or triple chamber design, field adjustable sensitivity; 24 VDC, detector mounted on housing complete with alarm light and local reset button; furnish sampling tubes to extend across full width of duct, anchor tubes at both ends and in intermediate locations as required to prevent sagging. The equipment provided shall include but not limited to: Simplex 2098-9649 Duct Housing, 2098-9798 Sampling Tube, 2098-11 Baffle, 2098-9201 Photoelectric Detector, 2098-9747 AC Power Adaptor.

PART 3 - EXECUTION

3.1 GENERAL:

- A. Provide a complete system of automatic temperature regulation applied to the air conditioning, heating and exhaust system.
- B. The entire control system, including low voltage wiring, with the exception of automatic dampers, shall be installed by the temperature control contractor, who shall make all tests and adjustments. All controls shall be field-tested and field-calibrated.
- C. Set points of all controlling instruments are indicated at a specific point; however, all set points shall be adjustable up and down from the point indicated.
- D. Provide and install duct-mounted smoke detectors where shown on plans.

3.2 ELECTRIC ACTUATORS:

- A. Supply and install electric motor operators for all dampers. Motors shall be spring to open, energize to close.

3.3 AUTOMATIC DAMPERS:

- A. Supply for installation by the Mechanical Contractor all motor operated dampers per the specifications of this Section.

3.4 SEQUENCE OF OPERATION:

- A. As shown on drawings.

3.5 DRAWINGS:

- A. TCSC shall furnish to the Engineer for approval, before commencing work on the system, blue prints of schematic control diagrams, including revised control diagrams from the original building.
- B. At the completion of the job, TCSC shall correct his drawings to include any changes made during construction.

3.6 ELECTRIC WIRING:

- A. Electric connections between the various unit control cabinets shall be made by the TCSC. All wiring must be tagged on both ends with panel number and terminal number.
- B. The TCSC shall also furnish and install all wiring to equipment furnished by him if such wiring is not shown.
- C. TCSC shall furnish and install all conduits, raceways, etc., required. TCSC shall furnish and install all control and interlock wiring. All wiring shall conform to standards and specifications outlined in Division 26 - Raceways. Wire size shall be in accordance with manufacturer's recommendations and National Electric Code. Minimum conduit shall be ½-inch diameter. TCSC shall furnish and install all required auxiliary starter contacts or relays, etc., for a complete electrical interlock and control wiring system.

3.7 OPERATION TEST:

- A. At completion, TCSC shall operate the system for a period of at least three days of eight hours each on the new systems to demonstrate fulfillment of the requirements of the contract. During this time, all adjustments shall be made to the equipment so that it is in first-class operating condition. The entire system is to be left in operating condition acceptable to the Engineer.

3.8 OWNER'S INSTRUCTION:

- A. Upon completion of the work and acceptance by the Owner, TCSC shall provide one scheduled four-hour period of formal instruction to the Owner's operating personnel who have responsibility for the mechanical system.

END OF SECTION 230900

SECTION 232300 - REFRIGERANT PIPING SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. The work required under this section includes all work necessary for a complete installation of refrigerant piping and accessories.
- B. The work of this section is subject to the requirements of the Mechanical General Provisions.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Basic Materials and Methods
- B. Air Cooled Condensing Units
- C. Air Handling Units With Coils

1.3 CODES AND STANDARDS:

- A. ANSI/ASHRAE 15-78 Safety Code for Mechanical Refrigeration
- B. ANSI B31.5 Refrigeration Piping Code

1.4 SUBMITTALS

- A. Submit manufacturer's literature on all products and accessories.

PART 2 - PRODUCTS

2.1 PIPING:

- A. Refrigerant piping shall be type L, hard drawn copper tubing conforming to ASTM Specification B-280, cleaned and capped and marked "ACR".
- B. Fittings for refrigerant lines shall be as wrought copper or forged brass conforming to ANSI/ASME standard B16.22.
- C. Joints in refrigerant lines shall be brazed.
- D. Brazed joints shall be made up in accordance with ANSI B9.1.

2.2 VALVES AND ACCESSORIES:

- A. Filter-drier shall be a Henry Valve Co., V-8000 series, filter-drier; Sporlan and Alco are approved equals.
- B. Service Valves:
 - 1. Valves shall be back seating type, steel or iron body. Valves shall be Henry Valve Co., Compressor Valves, Sporlan and Alco are approved equals.
- C. Isolation Valves:
 - 1. Isolation valves shall be Henry Valve Co., 900 series ball valves. Sporlan and Alco are approved equals.

- D. Charging Valve:
 - 1. Charging valve shall be a Henry Valve Co. type 927 or approved equal. Sporlan and Alco are approved equals.
- E. Sight Glass:
 - 1. Sight glass shall be Henry Valve Co. MI 31 series double port style with extended ends for soldering for lines 5/8 inch OD or larger. Use MI 30 series single port soldering for lines 5/8 inch OD or larger. Use MI 30 series single port for lines 1/2 inch OD and smaller. Sporlan and Alco are approved equals.
- F. Liquid Line Solenoid Valve:
 - 1. Valves shall be Sporlan "E" Series or Alco with molded coil, and extended solder connections. Valves shall be normally closed with manual lifting stem.
- G. Flexible Connectors:
 - 1. Flexible connectors shall be braided bronze covering on a bronze hose. End connectors shall be female copper tube type. Units shall be rated not less than 270 psi at 250 degrees F. Units shall be Southeastern Hose, Inc., Superior or Anaconda.

PART 3 - EXECUTION

3.1 GENERAL:

- A. Furnish and install the refrigeration equipment, piping and accessories, listed herein or shown on the drawings. Perform pressure and leakage tests. Evacuate the system; provide refrigerant charge and oil to properly operate the system. Adjust control devices for proper operation.
- B. The refrigeration system piping and accessories shall be installed in accordance with the Safety Code for Mechanical Refrigeration ANSI/ASHRAE 15-78 and the Refrigeration Piping Code ANSI/ASME B31.5.
- C. The refrigerant tube sizes and installation of tubing shall be in accordance with the equipment manufacturer's recommendations.
- D. Refrigerant suction line size shall limit the temperature rise to two degrees F at full load and hold the refrigerant gas velocity to not less than 500 ft. per min. (fpm) in the horizontal nor less than 1000 fpm in the vertical at minimum load.
- E. Refrigerant liquid line size shall limit the pressure drop between 4 and 6 psi at full load.

3.2 INSTALLATION:

- A. Provide a line size filter-drier in each liquid refrigerant line between the condenser and the expansion valve.
- B. Provide service valves at condensing unit. Service valves shall be lines size.
- C. Provide isolation valves around the filter-drier to permit servicing the drier without loss of refrigerant.
- D. Charging valve shall be installed in each liquid refrigerant line between the condenser and the filter drier.

- E. Sight glass, moisture indicator shall be installed in each liquid refrigerant line at the evaporator coil.
- F. Provide liquid solenoid valves in each liquid line. Valves shall be normally closed with manual lifting stem. Coil operating voltage shall be coordinated with Temperature Control Sub-Contractor.

3.3 WORKMANSHIP:

- A. Keep refrigeration piping sealed until it is used. Can open ends of installed piping until ready for final connections.
- B. Vertical refrigerant lines shall be run plumb; horizontal lines shall run parallel with building walls.
- C. Refrigerant lines shall not contact building structure. Isolate piping with resilient liner in pipe support or elastomeric insulation.

3.4 TESTING, DEHYDRATION, EVACUATION AND CHARGING:

- A. Upon completion of the piping systems, prior to insulation the piping system shall be tested at 350 psig for 2 hours.
- B. Charge refrigerant into the system to a pressure of 10 psig. Leaving the refrigerant in the system, pressurize the system with oil pumped dry nitrogen to 350 psig. Test for leaks with an electronic leak detector. Repair leaks, refill, re-pressurize, and retest. Discharge system pressure.
- C. Connect two vacuum pumps to system; one pump should be connected to the suction side of the system, the other to the liquid side. Pump both sides down to a vacuum of 500 microns, holding this vacuum for a period of 5 minutes.
- D. Connect a cylinder of oil pumped dry nitrogen and fill the system to atmospheric pressure. Reconnect vacuum pumps and evacuate again to 500 microns. Close charging valves and monitor vacuum for 12 hours. If the vacuum remains unchanged for 12 hours the system may be charged.
- E. Follow standard charging procedures. Charge through the system filter-drier.
- F. Check oil level after six hours of operation.
- G. Change filter driers after 40 hours of operation.

END OF SECTION 232300

SECTION 233113 - LOW PRESSURE DUCTWORK

PART 1 - GENERAL

1.1 SCOPE OF WORK:

- A. The work required under this section includes all work necessary for a complete installation of ductwork and accessories.
- B. The work of this section is subject to the requirements of the Mechanical General Provisions.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

- A. Basic Materials and Methods
- B. Insulation
- C. Electrical- Division 26

1.3 CODES AND STANDARDS:

- A. Sheet Metal and Air Conditioning Contractors National Association:
 - 1. HVAC Duct Construction Standards: Metal and Flexible
 - 2. Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems
- B. National Fire Protection Association:
 - 1. 90A - Installation of Air Conditioning and Ventilating Systems
 - 2. 90B - Warm Air Heating and Air Conditioning System
 - 3. 96 - Standard for the Installation of Equipment for the Removal of Smoke and Grease Laden Vapors from Commercial Cooking Equipment
 - 4. 101 - Code for Safety to Life
- C. American Society of Heating Refrigerating and Air Conditioning Engineers

1.4 SUBMITTALS:

- A. Submittals (for each duct system) shall include: duct shop fabrication standards indicating gauges, joint and reinforcement spacing, type of reinforcement, elbow fabrication, splitter damper and duct tap details, flanges, hangers and rod sizes, duct liner details, etc.
- B. Submittals shall include testing or listing certification, dimensional data and manufacturer's literature on all manufactured products.

PART 2 - PRODUCTS

- A. Ductwork shall be fabricated from sheet metal products conforming to the following material standards:
 - 1. Galvanized Steel - ASTM A525, A 526 and A527(G60)
 - 2. Exposed galvanized steel duct work shall be surface treated for painting.
 - 3. Duct system shall be fabricated with sheet metal thicknesses and reinforced in accordance with SMACNA and as described herein.
 - 4. Unless noted otherwise the minimum pressure/velocity classification shall be 2 inch W.G. plus or minus, at 2500 ft. per minute, duct seal class "A".
 - 5. All longitudinal seams shall be grooved, double or Pittsburgh type.
 - 6. Ducts 18 inches and larger on any side shall be stiffened by beading on not to exceed 12

inch centers.

2.2 GALVANIZED STEEL DUCTWORK:

- A. All junctions, bends, turns or elbows in all ducts or risers shall have a large radius (centerline radius equal to 1-1/2 times duct width) in the throat in order to minimize the frictional resistance. Vanes shall be provided in elbows with 90 degree throats and throat radii less than 1-1/2 times duct width, and shall be located in accordance with ASHRAE standards. Double-vane airfoil-type turning vanes shall be provided for all square turns.
- B. Branch connections in supply ducts shall be fabricated per the following schedule:

<u>Maximum Branch Size</u>	<u>Branch Connection</u>
Rectangular equivalent to 12 inch round	45 deg. tap collar with volume damper in branch
All other duct branches	Proportioned duct, with adjustable splitter damper
- C. Branch connections in return or exhaust ductwork shall be made with 45 degree entry fittings. If ducts are the same depth use parallel branch connection.
- D. Where acoustical or thermal insulation is applied on the inside of ductwork, size of ductwork shall be increased so that the duct size shown on the drawings are the dimensions of the inside of the insulation.
- E. Ductwork outside the building shall be fabricated of not less than no. 16 gauge galvanized steel.
- F. Install Duro-Dyne locking quadrants and Duro-Dyne end bearings on all splitters and manual volume dampers located above accessible ceiling and Young #1 regulator, C.P., and Duro-Dyne end bearings elsewhere.
- G. Branch duct connections for connecting round low pressure branches to rectangular low pressure trunks: Spin-in fittings with integral dampers with end bearings, stand-off and beaded collars. Seal Class of components penetrating duct shall be consistent with duct pressure class. Spin-in shall be Flexmaster – FLD or approved equal.

2.3 MISCELLANEOUS:

- A. Trapeze Hangers - ASTM A 36 Structural Steel
- B. Hanger Rod - ASTM A 36 or A 575 Threaded Hot Rolled Steel
- C. Duct Sealer: Solvent or water based type U.L. classified meeting NFPA 90A Class 1 with zero fire and smoke development rating. Sealer shall be United Sheet Metal, United Duct Sealer, or Hardcast Iron Grip No. 601.

2.4 FLEXIBLE CONNECTORS:

- A. Flexible connectors shall be U.L. listed, neoprene coated heavy glass fabric. Fabric shall be Ventglas, manufactured by Ventfabrics, Inc.

2.5 FLEXIBLE DUCTWORK:

- A. Flexible duct shall be UL listed and labeled as Class 1, Air Duct Connector, in accordance with U.L. Standard 181 and shall meet the requirements of the latest NFPA Bulletin, No. 90A and No. 90B for flame spread and smoke development rating.

- B. Flexible duct shall be rated for a maximum pressure of 6 inch positive and 3/4 inch negative and 4000 fpm maximum velocity. Air duct shall consist of: CPE liner, coated spring steel wire helix, fiberglass insulating blanket, fiberglass scrim and polyethylene film vapor barrier. Thermal conductance shall be .23 or less.

2.6 Duct shall be Thermaflex M-KC, Flexmaster Type 4M or prior approved equal. ACOUSTICAL AND THERMAL DUCT LINER:

- A. Acoustical and thermal duct liner shall be 1 inch thick Certain-Teed or Owens-Corning Aeroflex type 300 monolithic constructed, long glass fiber insulation with uniform density with the following acoustical efficiency:

Frequency	125	250	500	1,000	2,000	4,000
Efficiency	.16	.53	.41	.60	.84	.87

- B. Insulation and adhesives shall comply with the requirements of NFPA-90A (latest edition) as to flame spread and smoke development ratings. Liner shall meet the Erosion Test Method described in UL Publication No. 181.
- C. Insulation shall be secured to all duct surfaces by firmly pressing into wet adhesive applied to 100 percent of the duct surface. In addition, insulation on top, bottom and sides of horizontal ducts and all sides of vertical ducts shall be held in place with insulpins welded to duct on 12 to 18 inch centers and with clips slipped over the pins.

2.7 DAMPERS:

- A. Dampers and Deflectors:

1. Single Blade Dampers:

- a. Single Blade Dampers shall be constructed of the same material as the adjacent ductwork. Dampers less than 18 inches long shall be 22 gauge; dampers over 18 inches long shall be 16 gauge. Single blade dampers shall be limited to a 12 inch high blade. Blade edges shall be crimped or reinforced. Damper levers shall indicate positively the open and closed positions.

2. Multiblade Dampers:

- a. Multiblade dampers shall be constructed of sheet metal the same material as the adjacent ductwork. Damper frame shall be not less than 16 ga., damper blades not wider than 6 inches shall be the same material as the frame. Damper edge seals shall be EPDM, joint seals shall be metal compression type. Damper leakage shall be limited to 10 cfm per sq. ft. at 4 inch W.G. when tested in accordance with AMCA Standard 500. Damper shall be Ruskin CD 36 or prior approved equal.

- B. Fire Dampers (1-1/2 Hr):

- 1. Fire dampers shall be Underwriters approved and labeled (UL555). Fire dampers shall be Ruskin, IBD series for rectangular ducts, FD series for large openings, and FDR for round ducts. Dampers shall be fabricated of galvanized steel and shall be of such a design and length as to function as a wall mounting sleeve, which shall be a part of the fire damper. Sleeves shall be of welded or bolted construction. Crimping or tabs will not be acceptable substitutes for welding or bolting.
- 2. Air Balance and Prefco are approved equals.

- C. Counter Balanced Backdraft Damper:

- 1. Dampers shall have 14 gauge galvanized steel channel frame, 8 inches wide 16 gauge galvanized steel blades, 1/2 inch diameter plated steel axles, ball bearings, neoprene blade seals and jamb seals.
- 2. Dampers shall be Ruskin CBS7, Air Balance or Prefco.

2.8 DAMPER HARDWARE:

- A. All hardware shall be SMACNA accepted. Standard hardware shall be used on galvanized steel ductwork.
- B. Insulated ductwork (concealed) - Ventlok 638 elevated dial regulator.
- C. Insulated ductwork (exposed) - Ventlok 644 - self locking regulator.
- D. Uninsulated ductwork - Ventlok 555 or 560 Quadrants.

2.9 ACCESS DOORS:

- A. Access doors shall be hinged, constructed of the same material as the ductwork. Door edges shall be sealed with 3/4-inch wide x 1/8 inch thick neoprene sponge gasketing. Door hardware shall be Ventlok #100 latches. Access doors on insulated ductwork shall be double wall construction with 1 inch of rigid 3 PCF fiberglass insulation.
- B. Access doors shall be approximately 18 inches high by 24 inches wide. In smaller ductwork, the height shall be reduced to be 2 inches less than that of the ductwork.

2.10 LOUVERS:

- A. Louvers shall be 6" thick extruded aluminum louvers with 12 gauge blades with drainable head frame, drainable blades, water stop, and with angled sill. 57% F.A. minimum. Equip with 1/2" mesh aluminum birdscreen on inside of louver. Submit color sample and finish to Architect (20 year warranty on finish).

PART 3 - INSTALLATION

3.1 GENERAL:

- A. Provide angles (same material as duct) at points where duct penetrates walls, to close off space between wall opening and duct.
- B. Ductwork shall be constructed, reinforced and installed per SMACNA standards.
- C. Install, in the ductwork, dampers and air devices furnished by the Controls Contractor.
- D. Install smoke detectors in ductwork.
- E. Suspend horizontal ducts on not to exceed 6 ft. spacing by galvanized steel straps 1 inch x no. 16 ga. for sizes up to 60 inch width, 1-1/2 inch x no. 16 ga. for sizes up to 96 inch width, and 2 x 2 x 1/4 inch trapeze shelf angles for ducts wider than 96 inches. Unless noted otherwise straps shall be fastened to sides of ducts with not less than two sheet metal screws. Bottom ends of straps shall hook 2 inches under ducts and be secured with a sheet metal screw through bottom of ducts.
- F. Water and other pipes shall not be allowed to pass through air risers or ducts, unless absolutely necessary, and then only upon the approval of the Engineers, and when this occurs, the size of said duct or riser shall be proportionately increased. Sanitary waste and vent piping shall not penetrate any ductwork.

3.2 DUCT SEALER:

- A. All ductwork shall be as airtight as possible. Transverse seams shall be taped and sealed with two layers of United Sheet Metal, Uni-Cast or caulked with duct sealer.

3.3 FLEXIBLE CONNECTORS:

- A. Install flexible connectors at all supply and exhaust fans and other air handling units with inlet and outlet duct or casing connections.
- B. Connectors shall be suitable for the pressure of the units involved and shall be sealed airtight.
- C. Connectors shall be not less than 4 inches long (in clear) and properly attached to duct and fan connection collar by 1 x 1/8 inch draw band (fabricated of the same material as adjacent ductwork) firmly clamped around collars in such a manner as to be airtight and secured to collars with sheet metal screws. Connectors shall not be painted.
- D. Connectors shall not be used as transition pieces between fan and ductwork.

3.4 FLEXIBLE DUCTWORK:

- A. Flexible ducts shall be used for straight runs of duct or offsets up to 45 degrees, but not exceeding 48 inches in length. The use of flexible ducts or elbows more than 45 degrees will not be permitted.
- B. Flexible ductwork shall be secured to rigid ductwork and unit openings by sliding the flexible duct over the rigid duct, sealing with an approved adhesive, clamping with a suitable clamp and taping.

3.5 ACOUSTICAL AND THERMAL DUCT LINER:

- A. Where ductwork is lined, sheet metal duct shall be 2 inches greater in both dimensions than that indicated on drawings. Provide sheet metal lagging strip securely attached to duct with pop rivets to protect ends of insulation.

3.6 DUCT ACCESS DOORS:

- A. Provide duct access doors at all duct mounted devices requiring adjustment or resetting (e.g. fire dampers), at all ducted fan inlets.

3.7 DAMPERS:

- A. Install dampers where shown or called for on the drawing. Install damper operating hardware.
- B. Fire dampers shall be installed in accordance with manufacturer's instructions. Install style A fire dampers behind ducted grilles and registers in rated walls. Install style B or C fire dampers in ducted openings in rated walls.

3.8 LOUVERS:

- A. Make connections to louvers. Where duct size is less than full louver opening, close off remaining unused louver opening with an insulated panel assembly consisting of 24 ga galvanized sheet metal screwed to the louver, 2 in. thick 3 PCF fiberglass rigid board and covered with a 22 ga galvanized sheet metal outer skin. Seal all openings.

END OF SECTION 233113

SECTION 233713 - AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. This specification describes the air distribution outlets, exhaust and return air devices, and the accessories required for complete installation.
- B. The work of this section is subject to the requirements of Division 23 - Mechanical General Section.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

- A. Basic Materials and Methods
- B. Low Pressure Ductwork

1.3 CODES AND STANDARDS:

- A. Sheet Metal and Air Conditioning Contractors National Association:
 - 1. HVAC Duct Construction Standards - Metal and Flexible
- B. American Society of Heating, Refrigerating and Air Conditioning Engineers:
 - 1. Fundamentals - Handbook

1.4 SUBMITTALS:

- A. Submittals shall include manufacturers technical literature for performance (sound pressure loss, throw) pictorial literature, and schedule shall be submitted indicating the style and size of each diffuser or grille, location by room number, CFM of unit, throw, noise level, (NC rating) method of mounting and finish.

1.5 ACCEPTABLE MANUFACTURERS:

- A. Acceptable Manufacturers shall be Price, Titus, Anemostat and Krueger.

PART 2 - PRODUCTS

- A. Product performance data shall be taken from tests conducted in accordance with ISO Standard 5279, ISO Standard 3741, and ADC Test Code 1062 GRD 84.
- B. Exhaust grilles and registers including volume controllers for toilet rooms and janitors' closets, shall be constructed entirely of aluminum. Except where aluminum is specified, remainder of diffusers, grilles and registers may be constructed of steel including volume controllers.
- C. Grilles and frames constructed of aluminum shall have a 60 minute anodized aluminum finish. All other grilles and diffusers shall have a white flo-coat finish suitable as a finish coat or for field painting.
- D. Refer to architectural drawings for the various types of ceilings, i.e., mineral tile or plaster to assure that air devices have the correct type of mounting. Refer to drawings of reflected ceiling plans for location of ceiling diffusers and grilles.

- E. Supplier shall also check all air distribution and return air devices for proper performance, noise and accessories. Any device exceeding noise level herein specified shall be brought to the attention of the Engineers.
- F. Contractor shall coordinate openings in hard ceilings, furred walls, masonry walls, and floors.
- G. The nominal or duct connection size of grilles (not overall dimensions) is given on plans.
- H. Mounting frames shall be provided for all grilles and registers mounted in drywall, plaster, concrete or masonry openings.
- I. Devices are defined in the following manner in this section.

<u>Abbreviation used on the Drawings</u>	<u>Device</u>
Linear Slot Diffuser	LSD
Ceiling Diffuser	S
Supply Register	SR
Return Register	WRR
Exhaust Register	E
- J. A third letter following these abbreviations refers to the type of device which is defined herein.
- K. Linear Slot Ceiling Diffuser:
 - 1. Linear-slot extruded aluminum diffusers shall be Titus model ML-39 with adjustable air pattern through 180° from diffuser face. Two way blow from multiple slots, number of slots and lengths as shown on drawings. Diffusers shall be complete with end borders, mounting frame and integral volume damper.
 - 2. Plenums shall be furnished by manufacturer. Plenums shall have 1/2 inch coated insulation conforming to NFPA 90A. Plenum sizing in accordance with manufacturer's suggested designs. Plenums shall contain perforated plate to serve as distributing grid, mounted between dampered inlet and at entrance to diffuser stack head. Gauge of plenum per SMACMA standards.
- L. Ceiling Diffuser:
 - 1. Square Plaque style Face - 1-4 way, shall be Titus model D-OMNI-1 (surface) or AMD (lay-in). Removable core, square or rectangular neck, with air pattern shown on the drawings.
- M. Supply Registers:
 - 1. Type A – Titus model 1700 double deflection grilles with vertical face bars, on 3/4 inch spacing.
 - 2. Register shall include an AG-15 opposed blade damper.
- N. Return and Exhaust Grilles:
 - 1. Type A - Titus model 80, 1/2 inch aluminum grid for lay-in ceilings.
- O. VAV Diffuser:
 - 1. Shall be electronically controlled through a 12V DC actuator capable of varying the supply of cold and warm air into the space by means of regulating a variable aperture damper, known as a control disc, vertically in the diffuser. Supply air from the variable geometry diffuser shall discharge horizontally in a 360° pattern and shall maintain air movement in the space throughout the range of volume variation from 100% to 25%. When the zone temperature is 1° F above setpoint, the diffuser is in cooling mode. When the zone temperature is 1° F below setpoint, the diffuser is in heating mode. A built-in auto-calibration feature ensures that the volume control damper position is always correct. The face panel and backpan are constructed from 18 gauge steel. Titus TSQ-2 or equal.

PART 3 - INSTALLATION

- A. Provide air devices as indicated on the drawings. Mount each device securely to avoid rattling and vibration.
- B. Devices shall be parallel to the plane of the surfaces they are mounted on.
- C. Continuous linear devices shall be aligned, parallel to walls, with no perceptible distortion.

END OF SECTION 233713

SECTION 235020 – TESTING, BALANCING, & ADJUSTING

PART 1 - GENERAL

1.1 SCOPE:

- A. Provisions of this section apply to all HVAC work.
- B. All tests shall be witnessed by the Architect in addition to authorities having jurisdiction. A minimum of 48 hour notice is required prior to performance of test.
- C. Provide complete report to Engineer for approval TEN (10) working days prior to Engineer's final site visit.

1.2 QUALIFICATIONS:

- A. All TBA work shall be performed by an independent Test and Balance Agency specializing in Testing, Balancing and Adjusting of HVAC Systems.
- B. All TBA work shall be under supervision of a qualified registered professional engineer regularly engaged in the TBA Agency.
- C. TBA Agency shall be an AABC or NEEB Member and/or shall obtain written approval from the Architect prior to Bidding.

1.3 APPROVAL:

- A. Application for approval of the TBA agency shall be submitted prior to Bid.
- B. Submittal information regarding the TBA agency to include:
 - 1. List of at least five (5) projects successfully completed of similar size and scope.
 - 2. Copy of reporting forms to be used for this project indicating scope of TBA work.
 - 3. Name of registered engineer in charge with resume of qualifications. List of personnel that will perform TBA work on project and qualifications.
 - 4. List of instruments to be used with dates of latest calibrations.
 - 5. List of memberships in AABC, NEBB or other similar organizations.

PART 2 - PRODUCTS

2.1 INSTRUMENTS:

- A. All instruments used for the TBA work shall be calibrated within six (6) months and checked for accuracy prior to start of work.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS:

- A. After HVAC system has been installed, Test, Balance and Adjust System for proper operation, air distribution, flow rates, temperatures and humidities. Correct any noise and/or vibration conditions.

- B. Include a "Deficiency List" with the TBA air balance report. Deficiency list shall include TBA items which are not in accordance with Contract Documents.
- C. Perform all tests as required by local codes. Contractor shall furnish testing equipment.
- D. If local Codes are more stringent, local Codes shall govern.

3.2 AIR SYSTEM:

- A. When system has been completed, remove all trash and dirt, set grille bars and diffuser patterns for required throws and adjust and balance air duct systems so air quantities at outlets are as directed and distribution from each supply outlet is free from drafts and excessive noise, and uniform over the face of each outlet. Do all testing and balancing with filters blanked to provide pressure drops midway between clean condition and manufacturer's recommended change-out condition. Balance air quantities to within " 10% of indicated air quantities.
- B. Make adjustments so dampers and volume adjusters close to air outlets will have the least pressure drop consistent with volume requirements. Obtain additional pressure drop required for balancing of shorter runs by adjusting dampers at branch duct take-offs. Adjustable fan drives shall be used for making final adjustments of total air quantities. Change sheaves and belts as required to adjust AC units to proper airflow.
- C. Balance variable volume air systems with warm supply air (outlets will open to design cfm).
- D. Note that VAV terminals are specified to be factory calibrated. However, recalibrate each VAV box in the field as part of this work.
- E. Direct reading velocity meters may be used for comparative adjustment of individual outlets, but measure air quantities in ducts having velocities of 1000 feet per minute or more with pitot tubes. Cap pitot tube openings in low pressure ducts with plastic plugs. Cap pitot tube openings in medium and high pressure ducts and kitchen and laboratory exhaust ducts with Duro-Dyne test ports.
- F. Permanently mark settings of dampers and other volume adjusting devices so they can be restored if disturbed.
- G. When air balancing has been completed, submit to Architect an air balance log, including design and actual air quantities, pressures, etc., in each branch duct and at each grille, register, and outlet. Individual outlet air rates are required for boots on boot-box systems.
- H. Include for each system the following information:
 1. Fan rpm, motor amps, motor nameplate amps, and amp rating of starter heater.
 2. Total air quantity supplied by each system and/or fan.
 3. Total outside air quantity supplied by each system.
 4. Provide velocity pressure across each duct mounted smoke detector and list manufacturer's required velocity pressure range.
 5. Air flow at all grilles.

3.3 COILS:

A. Provide the following:

1. Entering and leaving air temperatures.
2. Outside air temperature at time of test.
3. Air pressure drop.

3.4 START-UP AND SERVICE:

- A. At the beginning of the first heating season, adjust and balance operating phases and repeat at the beginning of the first cooling season or vice-versa, as the case may be, all without charge.
- B. The Contractor and Factory Representative of the boilers, chillers, AC units and major HVAC equipment shall place every item of such equipment into satisfactory operation with all automatic and safety devices. Further, all adjustment service required shall be performed during the warranty period. Adjustment services does not include lubricating fans or motors and does not include changing filters or adjusting belts.
- C. In addition, submit equipment manufacturers' start-up reports for items listed above. See "Project Close-Out".

END OF SECTION 235020

PART 1 - GENERAL

1.1 SCOPE:

- A. Provisions of this Section shall apply to all HVAC work.

PART 2 - PRODUCTS

2.1 HEAT PUMP - (MINI-SPLIT):

- A. The Heat Pump system shall be a Mitsubishi Electric or approved equal split system with Variable Speed Inverter Compressor technology. The system shall consist of a ceiling-suspended indoor section with wired, wall mounted controller and a horizontal discharge, single phase outdoor unit.
- B. Quality Assurance
 - 1. The units shall be tested by a Nationally Recognized Testing Laboratory (NRTL) and shall bear the ETL label.
 - 2. All wiring shall be in accordance with the National Electrical Code (N.E.C.).
 - 3. The units shall be rated in accordance with Air-conditioning Refrigeration Institute's (ARI) Standard 210 and bear the ARI Certification label.
 - 4. The units shall be manufactured in a facility registered to ISO 9001 and ISO 14001, which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).
 - 5. A dry air holding charge shall be provided in the indoor section.
 - 6. The outdoor unit shall be pre-charged with R-410a refrigerant.
 - 7. System efficiency shall meet or exceed 13.0 SEER.
- C. Delivery, Storage and Handling
 - 1. Unit shall be stored and handled according to the manufacturer's recommendations.
 - 2. The wireless controller shall be shipped inside the carton with the indoor unit and able to withstand 105°F storage temperatures and 95% relative humidity without adverse effect.
- D. Warranty
 - 1. The units shall have a manufacturer's parts and defects warranty for a period one (1) year from date of installation. The compressor shall have a warranty of 6 years from date of installation. If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the manufacturer. This warranty does not include labor.
 - 2. Manufacturer shall have over 25 years of continuous experience in the U.S. market.

E. Performance

1. Each system shall perform in accordance to the ratings shown in the table below.
Cooling performance shall be based on 80°F DB, 67°F WB (26.7°C DB, 19.4°C WB) for the indoor unit and 95°F DB, 75°F WB (35°C DB, 29.3°C WB) for the outdoor unit.
Heating performance shall be based on 70°F DB, 60°F WB (21.1°C DB, 15.6°C WB) for the indoor unit and 47°F DB, 15°F WB (8.3°C DB, 6.1°C WB) for the outdoor unit.

F. Indoor Unit

1. The indoor unit shall be factory assembled, wired and tested. Contained within the unit shall be all factory wiring and internal piping, control circuit board and fan motor. The unit in conjunction with the wired, wall mounted controller shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit and refrigerant pipes shall be purged with dry nitrogen before shipment from the factory.

2. Unit Cabinet

The casing shall be ABS plastic and have a Munsell 0.70Y 8.59/0.97 finish. Cabinet shall be designed for suspension mounting and horizontal operation. The rear cabinet panel shall have provisions for a field installed filtered outside air intake connection.

3. Fan

The evaporator fan shall have three high performance, double inlet, forward curve sirocco fans driven by a single motor. The fans shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings. The indoor fan shall consist of four (4) speeds: Low, M1, M2, and Hi.

4. Vane

There shall be a motorized horizontal vane to automatically direct air flow in a horizontal and downward direction for uniform air distribution. The horizontal vane shall provide a choice of five (5) vertical airflow patterns selected by remote control: 100% horizontal flow, 80% horizontal flow (plus 20% downward airflow), 60% horizontal airflow (plus 40% downward airflow), 40% horizontal airflow (plus 60% downward airflow), and swing. The horizontal vane shall significantly decrease downward air resistance for lower noise levels, and shall close the outlet port when operation is stopped. There shall also be a set of vertical vanes to provide horizontal swing airflow movement selected by remote control.

5. Filter

Return air shall be filtered by means of an easily removable washable filter.

6. Coil

The evaporator coil shall be of nonferrous construction with pre-coated aluminum strake fins on copper tubing. The multi-angled heat exchanger shall have a modified fin shape that reduces air resistance for a smoother, quieter airflow. All tube joints shall be brazed with PhosCopper or silver alloy. The coils shall be pressure tested at the factory. A condensate pan and drain shall be provided under the coil.

7. Electrical

The electrical power of the unit shall be 208 volts or 230 volts, 1 phase, 60 hertz. The system shall be capable of satisfactory operation within voltage limits of 198 volts to 253 volts. The power to the indoor unit shall have an option of being supplied from the outdoor unit, using Mitsubishi Electric A-Control system or separate power source for indoor and outdoor units.

8. Control

- a. The control system shall consist of two (2) microprocessors, one on each indoor and outdoor unit, interconnected by a single non-polar two-wire cable. Field wiring shall run directly from the indoor unit to the wall mounted controller with no splices.
- b. For A-Control, a three (3) conductor 14 ga. AWG wire with ground shall provide power feed and bi-directional control transmission between the outdoor and indoor units.
- c. Where separate power is supplied to the indoor and outdoor units, a two (2) 20 ga. AWG wire shall be run between the units to provide bi-directional control communication..
- d. The system shall be capable of automatic restart when power is restored after power interruption. The system shall have self-diagnostics ability, including total hours of compressor run time. Diagnostics codes for indoor and outdoor units shall be displayed on the wired controller panel.
- e. The microprocessor located in the indoor unit shall have the capability of monitoring return air temperature and indoor coil temperature, receiving and processing commands from the wired controller, providing emergency operation and controlling the outdoor unit.
- f. The indoor unit shall be connected to a wall mounted wired controller to perform input functions necessary to operate the system. The wired controller shall have a large multi-language DOT liquid crystal display (LCD) presenting contents in eight (8) different languages, including English, French, Chinese, German, Japanese, Spanish, Russian, and Italian.
- g. There shall be a built-in weekly timer with up to eight pattern settings per day. The controller shall consist of an On/Off button, Increase/Decrease Set Temperature buttons, a Cool/Dry/Fan mode selector, a Timer Menu button, a Timer On/Off button, Set Time buttons, a Fan Speed selector, a Vane Position selector, a Louver Swing button, a Ventilation button, a Test Run button, and a Check Mode button. The controller shall have a built-in temperature sensor. Temperature shall be displayed in either Fahrenheit (°F) or Celsius (°C). Temperature changes shall be by increments of 1°F (1°C) with a range of 67°F to 87°F (19°C to 30°C).
- h. The wired controller shall display operating conditions such as set temperature, room temperature, pipe temperatures (i.e. liquid, discharge, indoor and outdoor), compressor operating conditions (including running current, frequency, input voltage, On/Off status and operating time), LEV opening pulses, sub cooling and discharge super heat.
- i. Normal operation of the wired controller shall provide individual system control in which one wired controller and one indoor unit are installed in the same room. The controller shall have the capability of controlling up to a maximum of sixteen systems at a maximum developed control cable distance of 1,500 feet (500 meters).

- j. The control voltage from the wired controller to the indoor unit shall be 12 volts, DC. The control signal between the indoor and outdoor unit shall be pulse signal 24 volts DC. Up to two wired controllers shall be able to be used to control one unit.
- k. Control system shall control the continued operation of the air sweep louvers, as well as provide On/Off and mode switching. The controller shall have the capability to provide sequential starting with up to fifty seconds delay.

G. Outdoor Unit

- 1. The outdoor unit shall be compatible with the indoor unit. The connected indoor unit must be of the same capacity as the outdoor unit.
- 2. The outdoor unit shall be equipped with a control board that interfaces with the indoor unit to perform all necessary operation functions.
- 3. The outdoor unit shall be capable of operating at -5°F (-18°C) ambient temperature without additional low ambient controls (optional wind baffle may be required).
- 4. The outdoor unit shall be able to operate with a maximum height difference of 100 feet (30 meters) between indoor and outdoor units.
- 5. System shall have a maximum refrigerant tubing length of 165 feet (50 meters) between indoor and outdoor units without the need for line size changes, traps or additional oil.
- 6. Cabinet

The casing shall be constructed from galvanized steel plate, coated with a finished with an electrostatically applied, thermally fused acrylic or polyester powder coating for corrosion protection and have a munsell 3Y 7.8/1.1 finish. The fan grille shall be of ABS plastic.

- 7. Fan

The fan motor shall be of aerodynamic design for quiet operation, and the fan motor bearings shall be permanently lubricated. The outdoor unit shall have horizontal discharge airflow. The fan shall be mounted in front of the coil, pulling air across it from the rear and dispelling it through the front. The fan shall be provided with a raised guard to prevent contact with moving parts.

- 8. Coil

The L shaped condenser coil shall be of copper tubing with flat aluminum fins to reduce debris build up. The coil shall be protected with an integral metal guard. Refrigerant flow from the condenser shall be controlled by means of linear expansion valve (LEV) metering orifice. The LEV shall be control by a microprocessor controlled step motor.

- 9. Compressor

he compressor shall be driven by inverter circuit to control compressor speed. The compressor speed shall dynamically vary to match the room load for significantly increasing the efficiency of the system which results in vast energy savings. To prevent liquid from accumulating in the compressor during the off cycle, a minimal amount of current shall be intermittently applied to the compressor motor to maintain enough heat. The outdoor unit shall have an accumulator and high pressure safety switch. The compressor shall be mounted to avoid the transmission of vibration.

10. Electrical

The electrical power of the unit shall be 208volts or 230 volts, 1 phase, 60 hertz. The unit shall be capable of satisfactory operation within voltage limits of 198 volts to 253 volts. The outdoor unit shall be controlled by the microprocessor located in the indoor unit. The control signal between the indoor unit and the outdoor unit shall be pulse signal 24 volts DC. The unit shall have Pulse Amplitude Modulation circuit to utilize 98% of input power supply.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Heat pumps shall be installed in accordance with manufacturer's recommendations.
- B. See details for mounting instructions and accessories.

END OF SECTION 15760

SECTION 237413 - PACKAGED ROOFTOP AIR CONDITIONING UNITS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. The work required under this section includes all work necessary for a complete installation of packaged rooftop air conditioning units with integral dehumidification package.
- B. The work of this section is subject to the requirements of the Mechanical General Section – Division 23.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

- A. Basic Materials and Methods Division 23
- B. Vibration Isolation Division 23
- C. Low Pressure Ductwork Division 23
- D. Temperature Controls Division 23
- E. Electrical Division 26

1.3 SUBMITTALS:

- A. Shop drawings shall include complete data on compressors, gas heating components, electric motors, V-belt drives, coils, casing construction, vibration isolation, and air filters.
- B. Fan data shall include: capacity, fan curve, RPM brake horsepower, fly wheel effect (WK^2), class, arrangement, sound power levels for each octave band.

PART 2 - PRODUCTS

2.1 GENERAL:

- A. Packaged rooftop air conditioning units shall be completely factory assembled including compressors coils, gas heating section, hot-gas reheat section (if scheduled), refrigerant circuits, condensate drain pan, fans, motor(s), starters, filters and controls in an insulated weather resistant casing, factory BACNET compatible card. Units shall be rated and tested in accordance with ARI standard 360. Units shall be UL listed and labeled and classified in accordance with ANSI Z21.47 and UL 465.
- B. Casing:
 - 1. Unit casing shall be constructed of zinc coated, minimum 22 gauge, ASTM A527 G90 galvanized steel. Exterior surfaces shall be cleaned, phosphatized and finished with a weather-resistant baked enamel finish. Seams shall be gasket sealed to be water tight.
 - 2. The air handling portions of the casing shall be completely insulated with coated, fire retardant glass fiber insulation, minimum 1-1/2 inches thick. Service panels with lifting handles and air tight seal shall provide access to all sections of the unit for maintenance. The base of the unit shall be suitable for mounting on a roof curb and shall have provisions for lifting by crane.

- C. Compressors:
1. Compressors shall be high efficiency, sealed hermetic rotary (scroll) or reciprocating type mounted on spring vibration isolators within the unit. Compressors shall be equipped with internal overcurrent and temperature protection as well as high and low pressure protection. Each refrigerant circuit shall have independent capillary expansion devices, service pressure ports and refrigerant line filter driers.
- D. Coils:
1. Evaporator and condenser coils shall be seamless copper tube type with mechanically bonded aluminum fins. Coils shall be factory leak tested to 200 psig and pressure tested to 450 psig.
- E. Fans and Blowers:
1. Evaporator fan shall be forward curved blade centrifugal type statically and dynamically balanced with adjustable V-belt drive. High efficiency motors shall be thermally protected. Fan and motor assemblies shall be spring isolated from the rest of the unit.
 2. Condenser fans shall be direct drive, vertical discharge propeller type, statically and dynamically balanced. Fan motors shall be permanently lubricated with built-in thermal overload protection.
- F. Gas Heating Section:
1. The natural gas fired heating section shall utilize an aluminum steel drum and tube type heat exchanger with pilotless spark ignition and forced combustion blower. Safety controls shall prevent continued gas flow if spark ignition fails. Heating section shall be factory pressure and leak tested and shall bear AGA approval.
- G. Filters:
1. Units shall be equipped with 2 inch thick, 30 percent efficient, pleated media type throw-away filters.
- H. Condensate Drain Pan:
1. Condensate drain pan shall be stainless steel or double wall galvanized steel with bituminous corrosion resistant coating. Pans shall be insulated on bottom side to prevent condensation.
- I. Acceptable manufacturers shall include Trane and Carrier.

PART 3 - EXECUTION

- A. Install unit in accordance with manufacturer's instructions.
- B. Install trapped condensate drain piping from unit to discharge into roof drain or gutter (refer to detail on the drawings).
- C. Turn units over to Owner with a clean set of filters.

END OF SECTION 237413

SECTION 237500 - CENTRIFUGAL FANS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. This specification describes the requirements for labor and materials necessary for the installation of centrifugal fans included as part of the building mechanical system.
- B. The work of this section is subject to the requirements of the Mechanical General Section – Division 23.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

- A. Basic Materials and Methods
- B. Vibration Isolation
- C. Low Pressure Ductwork
- D. Division 27

1.3 CODES AND STANDARDS:

- A. Air Movement and Control Association
 - 1. Standard No. 1-66 - Product Definitions
 - 2. Standard No. 2401-66 - Wheel Diameters and Outlet Areas for Centrifugal Fans
 - 3. Standard No. 2402-66 - Sizes for Industrial Centrifugal Fans
 - 4. Centrifugal Fans with Cast Housings
 - 5. Standard No. 2404-72 - Drive Arrangements for Centrifugal Fans
 - 6. Standard No. 2405-66 - Inlet Box Positions for Centrifugal Fans
 - 7. Standard No. 2406-66 - Designations for Rotation and Discharge of Centrifugal Fans
 - 8. Standard No. 2407-66 - Motor Positions for Belt or Chain Drive Centrifugal Fans
 - 9. Standard No. 2408-69 - Operating Limits for Centrifugal Fans
 - 10. Standard No. 2410-66 - Drive Arrangements for Tubular Centrifugal Fans
 - 11. Standard No. 2411-69 - Wheel Diameters and Outlet Areas-Tubular Centrifugal Fans
 - 12. Standard No. 2601-66 - Preparation of Centrifugal Fans and Parts for Protective Coatings

1.4 SUBMITTALS:

- 1. Submittals shall include: certified dimensional data, detailed construction drawings, and bearing sizes and model numbers. Submit operating data: RPM, capacity brake horsepower, class, arrangement, flywheel effect (WK2), sound power levels for each of the eight octave bands based on the specified operating conditions, and certified fan curves.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Fans shall be tested in accordance with AMCA standards and shall bear the AMCA seal. A certified performance curve shall be required for each fan.

- B. Unless noted otherwise, all fans shall have solid shaft with anti-friction, grease lubricated bearings. Bearings to be re-greasable ball or roller type sized for L-10 life of 400,000 hours per ANSI code B3.15 unless noted otherwise. Fan shafting shall be sized not to exceed 75 percent of the first critical speed under the specified operation conditions. The lateral static deflection of the shaft shall not exceed 0.003 inch per foot of the length of the shaft. The shaft and fan wheel shall be dynamically balanced in two planes as a complete unit to a maximum residual unbalance of 0.15 oz. at 95 percent of the fan wheel radius in each plane.
- C. Fans shall have all the accessories indicated in the schedule on the drawings.

2.2 FANS, CENTRIFUGAL IN-LINE:

- A. AMCA approved air and sound rated direct (or) belt driven fans (as scheduled) complete with V-belt drive sized for 50% overload, self aligning grease lubricated ball bearings, adjustable pitch motor pulleys, adjustable motor bases and statically and dynamically balanced backward curved blade wheels, all enclosed in a galvanized steel housing with inlet bell and outlet duct collars. (Fan wheel and motor assembly shall be hinged for access.)
- B. Fans shall be manufactured by Greenheck, Cook, Acme, Penn, Twin City or approved equal.

2.3 FANS, CENTRIFUGAL CEILING EXHAUST:

- A. AMCA rated direct drive centrifugal fans for ceiling mounting, complete with removable ceiling grille, disconnect, fan mounted solid state speed control, flexible duct connection, integral backdraft damper and discharge outlet.
- B. Fans shall be manufactured by Greenheck, Cook, Acme, Penn, Twin City, or approved equal.

PART 3 - EXECUTION

- A. Furnish and install fans indicated on the drawings and in accordance with the fan schedule.
- B. All fans shall be provided with a factory applied coating.

END OF SECTION 237500

SECTION 260500 - ELECTRICAL GENERAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. The "General Conditions" and "Special Conditions" of Contract as written and referred to hereinbefore are adopted and made part of Division 26.

1.2 DESCRIPTION OF WORK:

- A. Provide equipment, labor, etc., required to install complete working electrical system as shown and specified.
- B. Provide fixed electrical equipment, except where specifically noted otherwise.
- C. Provide portable electrical equipment for complete system.
- D. Provide equipment and/or wiring normally furnished or required for complete electrical systems but not specifically specified on the drawings or in specifications, as though specified by both.
- E. All equipment and wiring shall be new.
- F. Electrical work includes, but is not limited to:
 - 1. Arrange with local utility companies for services as shown or specified.
 - 2. Removal or relocation of electrical services located on or crossing through project property, above or below grade, obstructing construction of project or conflicting with completed project or any applicable code.
 - 3. Install panelboards, circuit breakers, power outlets, convenience outlets, switches, lighting fixtures and/or other equipment forming part of system.
 - 4. Provide and install all conduit and wiring as shown on drawing and as required for a complete and code complying electrical system.
 - 5. Complete raceway systems, wiring, and terminal facilities for telephone system.
 - 6. Connection of all appliances and equipment.
 - 7. Complete installation of emergency lighting and power system, including individual battery units.
 - 8. Complete system of outlets, and raceways for security and CCTV. Coordinate all requirements with Security Systems Contractor.
 - 9. Provide temporary facilities for construction power. Coordinate with local utility company.

1.3 WORK NOT INCLUDED:

- A. Furring for conduit and equipment.
- B. Finish painting of conduit and equipment.
- C. Installation of motors except where specifically noted.
- D. Control wiring for mechanical systems, except where indicated to be provided by Electrical Contractor.

- E. Flashing of conduits into roofs and outside walls. Inform General Contractor of number and size of roof penetrations prior to bidding.

1.4 RELATED WORK SPECIFIED ELSEWHERE:

- A. Classification of excavation: Architectural Division.
- B. Painting: Painting Division.
- C. Concrete Work: Concrete Division.

1.5 REQUIREMENTS OF REGULATORY AGENCIES:

- A. Obtain and pay for all permits required for the work. Comply with all ordinances pertaining to work described herein.
- B. Install work under this Division per drawings, specifications, latest edition of the National Electrical Code, Local Building Codes, and any special codes having jurisdiction over specific portions within complete installation. In event of conflict, install work per most stringent code requirements determined by Architect.
- C. Arrange, pay fees for and complete work to pass required tests by agencies having authority over work. Deliver to Architect Certificates of Inspection and approval issued by authorities.

1.6 QUALIFICATIONS OF CONTRACTOR:

- A. Has completed minimum two projects same size and scope in past five (5) years.
- B. This qualification applies to Sub-Contractors.
- C. Use workmen experienced in their respective trade. Submit qualifications of Superintendent for review.
- D. Owner reserves right to reject bid of any Contractor failing to meet these qualifications.

1.7 GENERAL JOB REQUIREMENTS:

- A. Drawings and Specifications:
 - 1. Electrical work is shown on "E" series drawings inclusive. Follow any supplementary drawings as though listed above.
 - 2. Drawings and specifications are complementary. Work called for by one is binding as if called for by both.
 - 3. Drawings show general run of circuits and approximate location of equipment. Right is reserved to change location of equipment and devices, and routing of conduits to a reasonable extent, without extra cost to Owner.
 - 4. Refer conflicts between drawings and specifications describing electrical work and work under other Divisions to Architect for remedial action.
 - 5. Use dimensions in figures in preference to scaled dimensions. Do not scale drawings for exact sizes or locations.
 - 6. Execution of Contract is evidence that Contractor has examined all drawings and specifications related to work, and is informed to extent and character of work. Later claims for labor and materials required due to difficulties encountered, which could have been foreseen had examination been made, will not be recognized.
 - 7. Charges for extra work not allowed unless work authorized by written order from Architect approving charge for work.

- B. Visit to Site:
1. Visit site to survey existing conditions affecting work. Include necessary materials and labor to accomplish the electrical work, including relocation of existing services and utilities on building site in bid. No consideration given to future claims due to existing conditions.
- C. Definitions:
1. Provide: Furnish, install and connect complete.
 2. Wire: Furnish all necessary wiring and connect complete.
 3. Install: Set in place and wire complete.
 4. Work: Materials completely installed and connected.
 5. AWG: American Wire Gage.
 6. NEC: National Electrical Code (latest edition)
 7. NFPA: National Fire Protection Association.
 8. OSHA: Occupation Safety and Health Administration.
 9. UL: Underwriters Laboratories, Inc.
 10. NEMA: National Electrical Manufacturers Association.
 11. IEEE: Institute of Electrical and Electronic Engineers.
- D. Workmanship, Guarantee and Approval:
1. Work under this Division shall be first class with emphasis on neatness and workmanship.
 2. Install work using competent mechanics, under supervision of foreman, all duly certified by local authorities. Installation subject to Architect's constant observation, final approval, and acceptance. Architect may reject unsuitable work.
 3. Furnish Architect written guarantee, stating that if workmanship and/or material executed under this Division is proven defective within one (1) year after final acceptance, such defects and other work damaged will be repaired and/or replaced.
 4. In event that project is occupied or systems placed in operation in several phases at Owner's request, guarantee will begin on date each system or item of equipment is accepted by Owner.
- E. Observations of Work and Demonstration of Operation:
1. At all observations of work, open panel covers, junction box covers, pull box covers, device covers, and other equipment with removable plates for check. Provide sufficient personnel to expedite cover removal and replacement.
 2. Contractor to assist Architect in demonstration of operation of new systems to satisfaction of Owner. Contractor to have manufacturer available for demonstration of systems where requested by Owner.
- F. Testing of Electrical Systems:
1. Test Completed work as follows:
 - a. Perform test required by Architect to indicate compliance with specifications, drawings and applicable codes. Provide instruments, labor and materials for tests.
 - b. Insulation - use 1000 VDC insulation tester (0-500 megohm full-scale), equal to "Megger" as manufactured by Biddle Company. Test conductors and busses of all systems, including feeders, branches, motors, devices, equipment, etc. Test branches for one (1) minute; test feeders, etc., for 15 minutes with readings at one minute intervals.
 - c. Receptacles: Use Woodhead Ground Loop Impedance Tester. Test each receptacle. Record readings.
- G. Ground Testing:
1. Testing of Made Ground Electrodes:
 - a. Test Ground Systems Indicated.
 - b. Using a measuring device which generates minimum of 500 VDC, calibrated in

- ohms (maximum 200 ohm scale) J.C. Biddle "Vibrotester" or approved equivalent.
- c. Provide test electrode in accordance with Measuring Device Manufacturer's instructions. Use ground rods as specified in Section "Grounding".
- d. Follow instructions of measuring device manufacturer for proper results.
- e. Test grounds only when earth is dry.
- f. Record ambient temperature, date, time, approximate water table level (as obtained from local geologists); type of earth material.

H. Materials and Substitutions:

- 1. All material shall be new, with U.L. label where available. If U.L. label is not available, material shall be manufactured in accordance with applicable NEMA; IEEE and Federal Standards.
- 2. No material substituted for specified, except by prior written approval of Architect. Specified catalog numbers are used for description of equipment and standard of quality only. Equivalent material given consideration only if adequate comparison data including samples are provided. Approval required prior to bid date. Submit substitution data 10 days prior to bid date. Bid substituted material only if approved in writing by Architect.
- 3. Submit to Architect within 30 days after award of contract a complete list of proposed material manufacturers. List does not preclude submission of shop drawings. Approval of manufacturer on list does not constitute approval of specific material or equipment.

I. Shop and Erection Drawings:

- 1. Submit complete shop drawings for all material and equipment furnished under Division 26 of specifications to Architect for review. Shop drawings shall be submitted on timely basis to allow adequate lead time for review, resubmission if necessary, manufacture and delivery to allow access of material to project at correct time based on schedule established by Architect/Contractor. Include complete descriptive data with dimensions, operating data and weight for each item of equipment. Carefully examine shop drawings to assure compliance with drawings and specifications prior to submittal to Architect.
- 2. Shop drawings and submittals shall bear the stamp of approval of the Contractor as evidence that the drawings have been checked by him. Drawing submitted without this stamp of approval will not be considered and will be returned for proper resubmission.
- 3. Submit 6 original copies for review. Architect will retain 2 copies and return 4 copies to Contractor.
- 4. Review of shop drawings does not relieve Contractor of responsibility for errors and omissions in shop drawings. Contractor is responsible for dimensions and sizes of equipment. Inform Architect in writing of equipment differing from that shown.

J. Cooperation:

- 1. Carefully coordinate work with other contractors. Refer conflicts between trades to Architect.
- 2. Work to be installed as progress of project will allow. Schedule of work determined by General Contractor and/or Architect.

K. Maintenance and Operating Instructions for Equipment:

- 1. Submit to Architect three (3) sets of data prepared by manufacturer for each item of electrical equipment completely describing equipment. Data to include parts lists, description of operation, shop drawings, wiring diagrams, maintenance procedures and other literature required for maintenance of equipment. Bind in booklet form for presentation.

L. "Record" Blue Line Prints:

- 1. Provide "Record" blue line prints at the completion of job. Keep set of prints on job and record day to day changes to Contract drawings with red pencil. One complete set of blue line prints will be furnished Contractor for record drawings. Indicate actual location of conduit systems, outlets, and equipment. Turn over prints to Architect at final

observation.

M. Items for Owner:

1. Provide following items for Owner at time of substantial completion:
 - a. Certificates of inspection and approval from authorities having jurisdiction.
 - b. Written guarantee.
 - c. "Record" blue line prints.
 - d. Final approved shop drawings (3 sets).
 - e. Spare fuses (furnish receipt).
 - f. Maintenance data (3 sets).
 - g. Affidavit of Owner Instruction (1 copy).

1.8 MARKING:

- A. Identify each starter, (including starters furnished under Mechanical Section), panelboard, cabinet, control device, breaker, disconnect and safety switch with 1/4" high black letters cut in a white laminated phenolic strip. Attach to enclosure with two (2) metal screws.
- B. Nameplates required for other items in this Division similar to those described above.

1.9 PROTECTION AND STORAGE:

- A. Provide warning lights, bracing, shoring, rails, guards and covers necessary to prevent damage or injury.
- B. Do not leave exposed or unprotected, electrical items carrying current. Protect personnel from exposure to contact with electricity.
- C. Protect work and materials from damage by weather, entrance of water or dirt. Cap conduit during installation.
- D. Avoid damage to materials and equipment in place. Repair, or remove and replace damaged work and materials.
- E. Exercise particular care when working around telephone (electronic) equipment to prevent entrance of dust, moisture and debris into the equipment. Provide dust barriers and partitions as required.
- F. Deliver equipment and materials to job site in original, unopened, labeled container. Store to prevent damage and injury. Store ferrous materials to prevent rusting. Store finished materials and equipment to prevent staining and discoloring. Store materials affected by condensation in warm dry areas. Provide heaters. Storage space on site and in building designated by Owner/Architect.
- G. Install equipment per manufacturer's recommendations. Conflicts between contract documents and these recommendations, deferred to Architect.

1.10 EXCAVATION AND BACKFILL:

- A. Excavate for work in this Division.
- B. Avoid existing facilities in excavating. Contractor is responsible for repair and replacement of damaged facilities in executing work.
- C. Backfill in twelve inch (12") lifts, wetted down and tamped. Compaction minimum 95% of

adjacent earth.

- D. Repairing to be comparable to work cut including new asphalt paving, concrete paving, sod, replanting shrubbery, etc. Architect will observe repair work, and reject unsuitable work.

1.11 ANCHORS:

- A. Provide anchors for all equipment, raceways, hangers, etc. to safely support weight of item involved. Anchors to consist of expansion type devices similar to "Redhead" or lead expansion anchors. Plastic anchors are not acceptable. Protect telephone equipment from drilling residue.

1.12 CLEANING AND PAINTING:

- A. Clean equipment furnished in this Division after completion of work.
- B. Touch-up or re-paint damaged painted finishes.
- C. Remove debris, packing cartons, scrap, etc., from site.

1.13 STARTERS:

- A. Separately mounted starters are furnished under another Division, but installed in Division 26 unless specifically noted otherwise.

1.14 CONTROL WIRING:

- A. Control Wiring including low voltage and line voltage interlock wiring will be furnished and installed under another Division, except where specifically shown otherwise. Carefully coordinate power and control wiring interface.

END OF SECTION 260500

SECTION 260501 - ELECTRICAL COORDINATION

PART 1 - GENERAL

1.1 DRAWINGS FOR MECHANICAL, PLUMBING, FIRE PROTECTION AND ELECTRICAL WORK

- A. Drawings contain diagrammatic layouts and indicate general arrangement of systems, piping conduit, etc.
- B. Prior to installation of material and equipment, review and coordinate work with Architectural and Structural Drawings and other Division work for exact space conditions; where not readily discernable request information from Architect before proceeding.
- C. Check Drawings of all other trades to verify extent of material and equipment to be installed in spaces available and consider layout alternatives so that all requirements can be accommodated.
- D. Maintain maximum headroom at all locations without finished ceilings.
- E. Maintain finished ceiling heights as indicated on Architectural reflected ceiling plans, and building sections and elevation drawings.
- F. Coordinate installations with other trades prior to proceeding to prevent conflict with work of other trades and cooperate in making reasonable modifications in layout as needed.
- G. Where conflicts occur with placement of mechanical and electrical materials as they relate to placement of other building materials, the Architect shall be consulted for assistance in coordination of the available space to accommodate all trades.
- H. Coordinate equipment installation to maintain manufacturer and code required working clearances.

1.2 PRIORITY OF CONSTRUCTION SPACE

- A. Following is the Order of Priority for Construction Space:
 - 1. First: Ductwork.
 - 2. Second: Fire protection piping.
 - 3. Third: Other piping.
 - 4. Fourth: Conduit.

1.3 COORDINATION DRAWINGS

- A. The Contractor shall prepare a complete set of background drawings at scale of minimum 1/4" equals 1'-0".
 - 1. The construction documents in their original, copies or electronic file form are the Architect's instrument of service and are protected under copyright laws. The reproduction of these documents for use as coordination drawings or shop drawings is prohibited without the Architect's written consent and authorization.
- B. Each specialty trade listed below shall prepare a coordination Mylar overlay indicating his work, with appropriate elevations and grid dimensions.
- C. Each specialty trade shall sign and date the coordination Drawing after the addition of his information.

- D. Fabrication shall not start until receipt of completed coordination drawings is acknowledged by the Contractor in writing to the Architect.
- E. Specialty Trades:
 - 1. Ductwork
 - 2. Fire protection piping
 - 3. Other piping
 - 4. Electrical
 - 5. Plumbing piping to include but not limited to sanitary, vent, pressure storm, medical gas (if provided), compressed air, natural gas, etc.
- F. Coordination Drawings required for all mechanical rooms, electrical rooms, equipment rooms, corridors, horizontal exits from duct shafts, cross overs and any other areas where congestion of work may occur.
- G. Coordination Schedule Drawing:
 - 1. The mechanical and plumbing contractor shall furnish to electrical contractor for coordination a schedule drawing providing all the electrical characteristics of all mechanical and plumbing equipment requiring electrical connection. The information provided shall include:
 - a. Unit Designation
 - b. Voltage
 - c. MCA
 - d. MOCP/MFS
 - e. FLA
 - f. Disconnect Requirement
 - g. Starter Requirement
 - h. Alarm Wiring Requirements
 - 2. The coordination schedule drawing, once received by the electrical contractor, shall be reviewed and all pertinent electrical accommodations indicated.
 - a. Breaker size.
 - b. Wire size / conduit size.
 - c. Disconnect with fuse size.
 - 3. Once the coordination schedule is completed forward to the engineers for review and approval.
- H. Conflicts that arise due to the fact that the coordination schedule drawing was not completed shall be the sole responsibility of the contractors. All costs for correction or remedial work shall be done at the contractor's expense. No added cost to the owner will be allowed.

END OF SECTION 260501

SECTION 260519 - CONDUCTORS (LOW VOLTAGE, 600 VOLTS)

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. Furnishing and installing 600 volt conductors for lighting, power, and auxiliary systems.

PART 2 - PRODUCTS

2.1 CONDUCTORS:

- A. 98% conductivity copper; #12 AWG minimum; #10 AWG and smaller solid, #8 and larger stranded.
- B. Conductors furnished with NEC, 600 volt, insulation as follows:
 - Dry locations: #10 AWG and smaller - type THW, THWN or XHHW
(do not intermix in circuits)
 - " 8 AWG and larger - type RHH-RHW-USE,
(cross linked polyethylene)
 - Wet locations: Exterior underground - type RHH-RHW-USE
Interior underground -type RHH-RHW-USE
- C. Wiring for controls and auxiliary systems #14 AWG minimum with NEC type THWN insulation.
- D. Branch circuits run in roof insulation, run in conduit on roof -use type RHH-RHW-USE insulation.
- E. Luminaire Wire: Incandescent - Use type SF-2, #16 for luminaires up to 300 watts, and #14 over 300 watts, except for luminaires in concrete pour use #12 or larger or as shown. Conductors in channels of, and flex to LED luminaires type THHN or XHHW.
- F. Cable - G.E. No. SI-58053 or approved equivalent.
- G. Color Code as follows and/or per local ordinances. Conductors #8 and smaller with colored insulation. Conductors #6 and larger not available in colors, color coded with colored pressure sensitive tape. Apply minimum 2" of tape to each individual phase or neutral conductor in half lapped pattern. The equipment ground conductor shall be taped green for its entire exposed length.
- H. Color-code as follows:

Phase	120/208 Volts
A	Black
B	Red
C	Blue
Neutral	White
Equip. Ground	Green
- I. Manufacturers of copper conductors: Pirelli, Okonite, Triangle, General Cable, Phelps Dodge, Capital Cable, Rome or Southwire.

PART 3 - EXECUTION

- A. Install wiring complete with connections to equipment.

- B. No wiring installed until after plastering and similar work is complete and dry.
- C. Install wiring so conductors are not in tension in completed system.
- D. Form wiring neatly and group in circuits. Tie grouped conductors with nylon ties, T&B "Tyrap" or approved equal.
- E. Use pulling compound of Ideal "Yellow 77", Minerallac No. 100, or approved equal. Do not use pulling compound for circuits on secondary side of ungrounded isolation transformers.
- F. Join and terminate copper conductors individually.
 - 1. Lugs in damp locations connected to copper bus: 98% conductivity copper or bronze Thomas & Betts "Locktite", Burndy "QA" or approved equivalent.
 - 2. Lugs in dry locations and lugs connected to aluminum bus - heavy casting aluminum, CU/AL rated, listed under UL Standard 486B, rated 90 degrees C; plated to prevent electrolysis, Thomas & Betts, Blackburn, IlSCO or approved equivalent.
- G. Provide lugs where not furnished as part of equipment - furnish as specified above, to connect all conductors.
- H. Furnish lugs for conductors #2/0 and larger with two bolt tongue or approved equivalent.
- I. Make conductor taps #2 and larger from a second conductor with 98% conductivity bolted insulated connector, T&B "IDT", IlSCO "KUP-L-TAP" or approved equivalent.
- J. Splice conductors #6 and larger with solid copper barrel, type fittings applied with an appropriate hydraulic tool. Splices used only where approved. Splice fittings: Burndy "Hydent". Insulate splices with 600 volt "heat shrink" covers T&B or equal.
- K. Joints #12 and smaller: T&B Sta-Kon wire joints EPT66M, with insulating caps, installed with WT161 Tool or C nest of WT11M Tool; Ideal Super/Nuts; Ideal Wing Nuts; 3M "Scotchlock" or Buchanan Electric Products B Cap or Series 2000 Pressure connectors complete with nylon snap on insulators installed with C24 pressure tool. Where conductors are connected to screw terminals, use nylon insulated, locking fork, T&B Sta-Kon or approved equal.
- L. Provide cable supports: As required by NEC. Supports with malleable screwed conduit fitting and non-conductive wedges drilled for the conductors; O.Z. Manufacturing Company or approved equal. Furnish pullbox, sized per NEC for each cable support.
- M. Bond circuit ground wires where installed to all devices, equipment, outlet and junction boxes, and grounding bushings (where provided) with a full size conductor and screw type connection.
- N. Securely fasten non-ferrous identifying tapes, pressure sensitive labels or engraved nameplates to all cables, feeders and power circuits in vaults, pull boxes, manholes, switchboard rooms, terminations of cables, etc.
- O. Mark all branch circuit conductors at panel terminations including neutrals with pressure sensitive numbers to correspond to circuit numbers connected.
- P. Connect circuits and feeders as shown on drawings. Drawings are diagrammatic and do not show every detail required in the wiring system. Detail wiring accomplished per NEC.
- Q. All conductors making up parallel feeders to be same size, same type, and same insulation, all cut same length. Bond each group of conductors making up a phase or neutral at both ends in an approved manner.

R. DO NOT COMBINE CIRCUITS unless specifically approved by the Architect.

END OF SECTION 260519

SECTION 260519.12 - METAL CLAD CABLE (MC)

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. Furnishing and installing 600 volt conductors for lighting, power, and auxiliary systems in a spiral flexible enclosure designated MC-Cable per applicable NEC Article.
- B. Furnishing and installing metal clad cable (MC) for branch circuit 20 amps in capacity for lighting and power circuits in areas with lay-in ceiling, and in stud walls.
- C. U.L. listed UL 1569 metal clad type MC cable

PART 2 - PRODUCTS

2.1 CONDUCTORS:

- A. Conductor 98% copper #12 AWG minimum type THHN insulation manufactured and tested in compliance with UL-83; insulation resistance 6-1 megohms per 1000 feet.
- B. Grounding conductors to be same size as phase conductors, and shall be insulated.
- C. Jacket shall be galvanized steel or metal clad aluminum, and shall be applied over the inner cable assembly with a positive interlock armor to wire grounding path in compliance with UL 1569.
- D. Circuit assembly shall be cabled (twisted) with suitable lay length, and covered with durable polyethylene terephthalate assembly tape.
- E. Product shall be as manufactured by Galflex, AFC Cable, Southwire, or approved equal.
- F. Color Code as follows and/or per local ordinances and as follows with colored insulation

<u>Phase</u>	<u>120/208 Volts</u>	<u>277/480 Volts</u>
A	Black	Yellow
B	Red	Orange
C	Blue	Brown
Neutral	White	Gray
Equipment Ground	Green	Green

PART 3 - EXECUTION

- A. Install cable only above accessible ceiling and in stud walls. Do not run from floor to floor.
- B. Installation shall be in accordance with applicable NEC Article. Support cable on 5-foot centers, and not more than 12-inches at box or cabinet. (Support independent of ceiling).
- C. Fittings and connectors shall be products specifically designed for MC cable.
- D. Joints #12 and smaller: T&B Sta-Kon wire joints EPT66M, with insulating caps, installed with WT161 Tool or C nest of WT11M Tool; Ideal Super/Nuts; Ideal Wing Nuts; 3M "Scotchlock" or Buchanan Electric Products B Cap or Series 2000 Pressure connectors complete with nylon snap on insulators installed with C24 pressure tool. Where conductors are connected to screw terminals, use nylon insulated, locking fork, T&B Stan-Kon or approved equal.
- E. Bond circuit ground wires where installed to all devices, equipment, outlet and junction boxes, and grounding bushings (where provided) with a full size conductor and screw type connection.
- F. Securely fasten non-ferrous identifying tapes, pressure sensitive labels or engraved nameplates to all cables, feeders and power circuits in vaults, pull boxes, manholes, switchboard rooms,

terminations of cable, etc.

- G. Mark all branch circuit conductors at panel terminations including neutrals with pressure sensitive numbers to correspond to circuit numbers connected.
- H. Connect circuits shown on drawings. Drawings are diagrammatic and do not show every detail required in the wiring system. Detail wiring accomplished per NEC.
- I. Circuiting where drawings do not show circuit conductors provide same as required to provide complete control and connections as designated by circuit numbers.
- J. Install MC cable only above accessible ceilings and on drywall construction. Where conductors must pass thru or in non accessible and exposed area provide circuits in EMT or rigid as required by code.
- K. MC cable is not permitted to be the homerun to the panel.
- L. DO NOT COMBINE CIRCUITS unless specifically approved by the Engineer.

END OF SECTION

SECTION 260533 - RACEWAYS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. Installation of raceway systems including required fittings for all work in Division 26.

PART 2 - PRODUCTS

- A. Rigid galvanized steel conduit to conform to ASA Standard C80.1 and U.L. Standard No. 6 for rigid metallic conduit, except hot dipped galvanized after threading. Conduits manufactured by Republic, Wheatland, Southwire, Clifton, Triangle, or Walker.
 - 1. Fittings, ells, couplings, etc., galvanized threaded type shall meet above standards. Threadless fittings not allowed.
 - 2. Terminate rigid conduit with two locknuts, one inside, one outside of the cabinet, junction or outlet and a bushing. Bushing - malleable iron with smooth bakelite ring molded into edge of bushing to prevent damage to cable, OZ Mfg. Co., type "B" or approved equal. Where grounding bushings are required, construction of bushing similar to above except a lug provided for grounding connection, OZ type "BLG" or approved equal.
- B. Rigid intermediate grade conduit, IMC, to conform to UL Standard No.1242; hot dipped galvanized or approved equivalent. Manufactured by Allied, Southwire, or ETP.
 - 1. All fittings, ells, couplings, etc., constructed to same standards as rigid steel conduit. Fittings - threaded type with all threads engaged. Use "Uni-swivel" couplings in dry locations only.
 - 2. Conduit terminations same as rigid steel conduit.
- C. Flexible steel conduit, "Greenfield", continuous spirally wound and inter-locked, threadless, galvanized conforming to U.L. and CSA Standards for flexible steel conduit; manufactured by National Electrical Products or International Metal Hose Company.
 - 1. Connectors and fittings galvanized steel, threadless type with insulated throats, U.L. approved for grounding means, Thomas & Betts, Efcor, Midwest, Appleton, Racor, Steel City, or ETP.
- D. Liquid tight flexible steel conduit constructed similar to flexible steel conduit above, except with polyvinyl chloride jacket, as manufactured by Anaconda "Sealtite" or Robroy - "Flex".
 - 1. Fitting Assembly - sealing type, with steel gland, nylon ring and ground cone inside locknut. All fittings with insulated throat, U.L. approved for grounding means. Fittings - Thomas & Betts, Efcor, Midwest, Appleton, Racor, Steel City or ETP.
- E. Electrical metallic tubing, EMT, threadless, steel type conforming to ASA Standard C80.3 galvanized inside and out, and with additional corrosion resistant finish. EMT manufactured by Republic, Wheatland, Pittsburgh Standard, Southwire, Clifton, Spang-Chalfont, Triangle, Walker, or ETP.
 - 1. Fittings, connectors, couplings, etc., insulated throat galvanized steel, raintight, set-screw type; Thomas & Betts, Efcor, ETP, Midwest, Racor, Appleton, or Steel City.
- F. Plastic conduit, PVC, polyvinyl chloride compound, rated for direct burial, Schedule 40, except as noted otherwise, manufactured by Carlon, Sedco, ETP, Can-Tex or approved equivalent.
 - 1. Fittings same material as conduit and installed with watertight joint compound recommended by manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Install conduit as follows:
 - 1. Use rigid steel or intermediate grade conduit for:
 - a. Circuits in hazardous locations.
 - b. Circuits exposed to mechanical damage.
 - c. All motor circuits.
 - 2. Use electrical metallic tubing, EMT, for:
 - a. Branch circuits & feeders in dry locations.
 - b. Telephone circuits.
 - c. Auxiliary Systems and Controls (low voltage systems such as fire alarm, security systems, etc)
 - 3. PVC conduit for:
 - a. Individual ground wires.
 - b. Circuits run in concrete slab
 - c. Circuits run underground where indicated.
 - d. Where specifically shown on drawings.
 - e. Site lighting circuits.
 - f. No PVC shall be exposed
- B. Size conduit per NEC. Minimum size 3/4" diameter.
- C. Run conduit concealed where possible. Run concealed conduit above furred ceiling in an orderly manner. Multiple conduits are to be grouped and run parallel.
- D. In concrete slab: Install conduits in center of concrete slabs and tie to reinforcing steel with tie wires. Do not install conduit larger than 1" in concrete slabs unless approved by Architect. Install with minimum of 2" between parallel runs. Do not cross conduits in slab unless necessary, then only one conduit crossover in 12" space.
- E. Exposed Conduit: Use only where specifically shown or approved. Run perpendicular to building walls and partitions and tight against structure. Conceal vertical portion of conduits where possible.
- F. Paint underground metal conduit with 2 coats of asphaltum or bituminous. Make underground conduit fittings watertight using Teflon tape. Do not use split couplings and similar fittings underground and exposed to moisture. Run underground conduits minimum 24" below grade. Do not run conduit in slag fill.
- G. Paint conduit fittings and threads exposed to moisture with Rustoleum silver paint after installation.
- H. Furnish offsets required to meet field conditions. Make bends in conduit in accordance with the National Electrical Code, except make minimum radius of 6 times conduit diameter or 6" whichever is greater. Bend IMC conduit without deforming.
- I. Where conduit crosses expansion joints, install expansion type fittings OZ type EX with bonding jumper or approved equal.
- J. Make connections to equipment away from wall with conduit extensions exposed from ceiling to floor, anchored with floor flange and/or angle frame as required. Make connections to equipment with flexible conduit from tee conduit in conduit riser.
- K. Vibrating equipment and equipment requiring adjustment, i.e.: motors, transformers, etc: make final connections with flexible conduit.

- L. Isolate conduit connections to equipment on roof from roof penetration of conduit with short section of flexible conduit between roof penetration and equipment.
- M. Use liquidtight flexible conduit where exposed to moisture, oil, etc.
- N. Install conduit to avoid hot water pipes. Maintain 9" clearance of such pipes, unless closer crossings are unavoidable. Maintain minimum 1" clearance from covering of pipe crossed.
- O. Support conduit per NEC. Support individual conduits with galvanized hangers and rods as follows:
 - 1. 1" diameter and smaller 1/4" dia. rod.
 - 2. 1-1/4" to 3" diameter 3/8" dia. rod.
 - 3. Larger than 3" diameter 1/2" dia. rod.
- P. Individual conduit hangers - Minnerallac, or approved equal. Support EMT near each joint. Support for multiple conduit runs consist of Unistrut channel as required with 1/2" diameter galvanized bolts or rods anchored to structure. Provide "U" bolt clamps for each conduit on hangers. Support vertical riser conduits with galvanized bolted clamps at each floor. Do not support conduit to ceiling support system.
- Q. Terminate conduits entering sheet metal boxes with double locknuts and bushings. Terminate conduit exposed to moisture with watertight hubs.
- R. Where ground conductor installed in conduits 1-1/4" and larger provide grounding bushings, and bond full size ground wire to bushings and from bushing to box or cabinet. Bond with self-tapping screw and appropriate lug. Where ground wires are run in smaller conduits, bond to outlet and junction boxes with self-tapping screw lug. Provide other conduits with non-grounding bushings as described under another article. Provide all service entrance metallic raceways with grounding bushing and bond to ground bus; bond sized per table 250-94c NEC.
- S. PVC Conduit Installation:
 - 1. Above ground: Allow for expansion and contraction.
 - 2. Below grade: Encase in 3" sand fill. Backfill free of large rocks and debris.
 - 3. Make elbows, bends, etc., with heated bender when factory bends are not available.
 - 4. When below slab, provide rigid elbows.
 - 5. Make cuts with hacksaw and deburr ends.
- T. Make joints as follows:
 - 1. Clean outside of conduit to depth of socket, and inside of socket with approved cleaner. Apply solvent cement to interior of socket and exterior of conduit, Insert conduit in socket and rotate 1/4 to 1/2 turn and allow to dry.
 - 2. Where non-metallic conduit is used for power wiring install insulated ground wire, sized per NEC unless shown larger.
- U. Sleeves:
 - 1. Provide sleeves for raceways penetrating floor and structural members. Sleeves consist of Electrical Metallic Tubing set in forms. (Exception: Use Schedule 40 PVC for individual ground conductors).
 - 2. Size sleeves to allow 1/2" clearance around raceway extending from bottom of floor construction to 2" above floor, minimum sleeve size 2-1/2" diameter. After raceways are installed, seal space between the raceway and sleeve with non-hardening, fireproof, compound, CTC PR-855 sealant, T&B "Flame Safe" for 2 hour fire rating or approved equal.

END OF SECTION 260533

SECTION 260536 - OUTLET BOXES, JUNCTION BOXES, GUTTERS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK:

- A. Outlet, junction boxes, conduit bodies, wiring gutters and their installation.

PART 2 - PRODUCTS

2.1 OUTLET AND JUNCTION BOXES:

- A. Provide wiring devices, fixtures and special system outlets with outlet box. Use galvanized steel for concealed boxes and exposed boxes in dry locations. Use cast iron conduit fittings similar to "Condulets" or "Unilets" with threaded hubs for exposed boxes outside and exposed to moisture.
- B. Concealed outlets and exposed outlets in unfinished spaces for lights, switches, wall receptacles, etc.; consist of standard galvanized steel outlet boxes and plaster rings.
 - 1. Provide 1/16" thick boxes and covers of form and dimension adapted to its specific use and location, kind of fixture to be used and number, size and arrangement of connecting conduits.
 - 2. Provide 3/8" fixture studs where required.
 - 3. Ceiling Outlet Boxes: 4" octagonal or 4-11/16" square as required, due to number of wires, and 2" deep minimum. Ceiling boxes in slabs concrete type. Plaster rings not required for ceiling outlet unless needed for device.
 - 4. Paint junction boxes provided with blank covers to match surroundings, except use blank device plates in finished areas.
 - 5. Switch and receptacle outlet boxes: 4" square with plaster rings as necessary. Provide multi-gang boxes where shown or required. Provide metal barriers to separate emergency and normal service wiring per N.E.C. Steel City, Appleton, Raco, Bowers or approved equivalent.
- C. Use galvanized cast iron boxes, approved equivalent to Crouse-Hinds type "FS" or Appleton condulets, with appropriate covers for wall outlets in exposed conduit work and exposed to moisture.
- D. Use galvanized cast iron boxes equivalent to Crouse-Hinds type GRF for ceiling outlets in exposed conduit work exposed to moisture. Use square cut steel outlet boxes for outlets exposed in finished locations. Use round or square to adapt to device installed. Wiremold, Hoffman or approved equivalent.

2.2 LARGE JUNCTION BOXES:

- A. Furnish pull, tap and cable support boxes required by NEC for excessive number of 90 degree conduit bends, conductor taps and cable supports.
 - 1. Box construction per NEC and manufactured with galvanized sheet steel, 12 gage minimum, with angle iron frame where required for rigidity; welded or bolted construction. Install bolts to prevent damage to cables in box.
 - 2. Boxes with removable screw type covers and plated screws. Provide split covers where necessary for access. Maximum single piece cover - 36" x 36".
 - 3. Provide separate junction boxes for each feeder. If conduit is installed so separate junction boxes are not practical, one large pull-box may be used with each set of feeder conductors separated by 12 gage steel barriers. Furnish junction box or each compartment in junction box with ground lug for connection of ground wire.

2.3 CONDUIT BODIES:

- A. Conduit bodies shall be installed to provide ease of pulling conductors and to provide neat appearance of conduit installation, and as shown on drawings. Conduit bodies constructed of malleable iron or copper free aluminum castings. Bodies shall be finished with standard durable exterior coatings of manufacturer specified. Provide rollers in type "C" and type "LB" bodies, 1-1/4" size and larger. Provide gasketed plated steel or malleable iron covers.
- B. Conduit bodies shall be manufactured by Crouse-Hinds, Pyle National, Killark, Appleton or approved equivalent.

2.4 SURFACE METAL RACEWAYS:

- A. Where indicated on the drawings, wiring shall be run in exposed metal raceways, metal molding or wiremold complete with outlet boxes and fittings. All circuits run in surface metal raceways shall have a ground conductor with green insulation sized per the NEC, but not smaller than No. 12 AWG screw connected to each outlet box. All wiring in surface metal raceways shall be type "THWN" conductors.

PART 3 - EXECUTION

3.1 INSTALLATION OF OUTLET BOXES:

- A. Fasten outlet boxes securely to structure.
- B. Set all flush outlet boxes so edge of device flange is flush with finished surface.
- C. Open no more knockouts in outlet box than required.
- D. Seal boxes during construction.
- E. Stagger back to back boxes 3" minimum.
- F. Support All Boxes:
 - 1. Outlet boxes - with 1/4" diameter galvanized rods or bolts anchored to structure.
 - 2. Outlet boxes for surface mounted luminaires on furred ceilings with 3/4" channel iron fastened to ceiling channels. See Section covering "Luminaires".
 - 3. Pull, junction and cable boxes with 3/8" diameter galvanized rods or bolts (4 minimum).
 - 4. Support outlet boxes in steel stud partitions with Caddy "BHA" bar hangers or approved equivalent.
- G. Install adjacent outlets at different levels in one vertical line where possible.
- H. Provide green covered bonding jumper, screw connected to outlet box in all receptacle boxes.
- I. Paint wiring connections in ground mounted outlets or floor outlets in wet locations with "Scotchkote" and fill box with "Duxseal".
- J. Mark outlet box covers with black permanent ink markers to indicate circuit number(s) and panel of origination.
- K. Use 4" octagonal boxes with blank covers for master outlets, installed to permit installation of collars by others.
- L. Where outlet boxes installed in unfinished concrete walls or columns, provide 1" deep plaster

ring with box and ring set in position before the concrete is poured so concrete will fill around the ring and cover plate can be installed flush with the unfinished surface. In case of brick walls, follow same procedure with mason filling around the plaster ring with mortar.

- M. Install all outlets located on columns on centerline of column and bend or shift reinforcing so that the outlet box will be flush with the finished concrete. Provide plaster rings as required so that the plate is flush with the finished plaster or exterior concrete surface.
- N. Install conduit bodies where shown or where required for sharp bends and/or aesthetics in raceway system. Do not use in lieu of pullboxes except in limited space or as directed by Architect.

END OF SECTION 260536

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Lighting Control Devices, unless otherwise noted, are to be provided by the contractor. Installation of all lighting control devices to be by the electrical contractor.
- B. Provide shop drawings for all lighting control devices.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.3 SUMMARY

- A. This Section includes the following lighting control devices:
 - 1. Outdoor photoelectric switches.
 - 2. Indoor occupancy sensors.
 - 3. Multi-pole contactors.
- B. Related Sections include the following:
 - 1. Division 26 Section "Switches and Receptacles" for manual light switches.

1.4 DEFINITIONS

- A. LED: Light-emitting diode.
- B. PIR: Passive infrared.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show installation details for occupancy and light-level sensors.

PART 2 - PRODUCTS

2.1 GENERAL LIGHTING CONTROL DEVICE REQUIREMENTS

- A. Line-Voltage Surge Protection: An integral part of the devices for 120- and 277-V solid-state equipment. For devices without integral line-voltage surge protection, field-mounting surge protection shall comply with IEEE C62.41 and with UL 1449.

2.2 OUTDOOR PHOTOELECTRIC SWITCHES

- A. Description: Solid state, with SPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, microprocessor input, and complying with UL 773A.
 - 1. Light-Level Monitoring Range: 1.5 to 10 fc (16 to 108 lx), with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of photocell to prevent fixed light sources from causing turn-off.
 - 2. Time Delay: 15-second minimum, to prevent false operation.

3. Surge Protection: Metal-oxide varistor type, complying with IEEE C62.41 for Category A1 locations.
4. Mounting: Twist lock complying with IEEE C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the North sky exposure.

B. Approved Product: K4000 series by Intermatic, or equal by Tork or Paragon.

2.3 INDOOR OCCUPANCY SENSORS

A. Wall or ceiling mounted sensor:

1. Switch Box Sensors: PIR type with integral power-switching contacts rated for 800 W at 120-V ac, suitable for incandescent light fixtures, fluorescent light fixtures with magnetic or electronic ballasts, LED fixtures & associated LED drivers, or 1/6-hp motors; (rated 1000 W at 277-V ac).
2. Install according to manufacturer's instructions. Install and aim sensors in locations to achieve at least 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

2.4 MULTIPOLE LIGHTING CONTACTORS

A. Approved Manufacturers:

1. Allen-Bradley/Rockwell Automation.
2. ASCO Power Technologies, LP; a division of Emerson Electric Co.
3. Cutler-Hammer; Eaton Corporation.
4. GE Industrial Systems.
5. Square-D

B. Description: Electrically operated and electrically held, complying with NEMA ICS 2 and UL 508.

1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
2. Control-Coil Voltage: Match control power source.

2.5 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG.

B. Classes 2 and 3 Control Cable: Multi-conductor cable with stranded copper conductors not smaller than No. 18 AWG.

C. Class 1 Control Cable: Multi-conductor cable with stranded copper conductors not smaller than No. 14 AWG.

D. Provide unshielded, twisted-pair cable for control and signal transmission conductors.

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

A. Install according to manufacturer's instructions. Install and aim sensors in locations to achieve at least 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

- B. Do not install ultrasonic or dual-technology occupancy sensors closer than 4 feet from air supply outlets / diffusers.

3.2 WIRING INSTALLATION

- A. Wiring Method: Comply with Division 26 Section "Conductors." Minimum conduit size shall be 3/4 inch.
- B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and non-power-limited conductors according to conductor manufacturer's written instructions.
- C. Provide field-mounting transient voltage suppressors for lighting control devices locations that do not have integral line-voltage surge protection.
- D. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.
- F. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 IDENTIFICATION

- A. Identify components and power and control wiring.
- B. Label time switches and contactors with a unique designation. Provide a typewritten directory identifying circuits and spaces controlled by contactors.

3.4 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test in compliance with manufacturer recommendations.
 - 2. Operational Test: Verify actuation of each sensor and adjust time delays per manufacturer's instructions.
- B. Remove and replace lighting control devices where test results indicate that they do not function properly.
- C. Additional testing and inspecting, at Contractor's expense, may be performed to determine compliance of work with specified requirements.

3.5 ADJUSTING

- A. Occupancy Sensor Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose.

END OF SECTION 260923

SECTION 261013 - SERVICE CHARACTERISTICS

PART 1 - GENERAL

1.1 RATING:

- A. Secondary Service: Unless otherwise noted on the drawings, 120/208 volts, 3 phase, 4 wire, grounded neutral, wye connected.

1.2 SERVICE AND UTILITIES:

- A. Arrange with local electric service company for service to be brought to building, and for the installation of meter. Pay all charges (if any) in connection therewith, including permanent meter deposit, which deposit will be refunded to Contractor at time of Owner's occupancy of the building.
- B. It is responsibility of this Section, prior to bid, to re-affirm with Utility Companies involved, that locations, arrangement, Power Company voltage, phase, metering required, and connections to utility service are in accordance with their regulations and requirements. If their requirements are at variance with these drawings and specifications, contract price shall include an additional cost necessary to meet those regulations without extra cost to Owner after bids are accepted.
- C. Obtain from Utility Company any additional charges for service of type, size and location called for. Include charges in bid to be paid by Contractor to appropriate party. Provide payment of these charges so as to allow logical progression of construction and avoid delay of completion.
- D. Should cost above not be available prior to bid, submit with bid a letter signed by responsible Utility Company personnel stating that cost is not available. Prime Contractor shall submit letter with his bid to Owner. Cost will then be omitted from contract and become responsibility of Owner.
- E. Furnish with shop drawings a signed document from each utility company describing location and type of service to be supplied and requirements for service. Document shall be signed by the appropriate responsible representative of the respective Utility Company.

PART 2 - PRODUCTS (Not Applicable):

PART 3 - EXECUTION

3.1 POLE MOUNTED TRANSFORMER:

- A. Service to facility consists of underground secondary service from a pole mounted transformer to main distribution equipment.
- B. Power Company furnishes and installs following:
 - 1. Connections to pole mounted transformer.
 - 2. Pole mounted transformer complete.
- C. The Electrical Contractor shall furnish and install following:
 - 1. Primary duct bank as shown on site plan. Duct bank consists of PVC duct encased in sand fill as shown. See Section covering "Raceways". Use long radius, 36" minimum, PVC elbows, same as duct. Terminate ducts as directed by Power Company.
 - 2. Secondary service consisting of conductors in conduit. Provide 35 feet of coiled up conductor at base of pole for utility company to terminate to pole mounted transformer.
 - 3. Coordinate all service work with Power Company and install the work in accordance with their requirements and recommendations.

3.2 PAD MOUNTED TRANSFORMER:

- A. Service to facility consists of underground primary service from riser pole to new pad mounted transformer, with underground secondary service from the transformer(s) to main distribution equipment.
- B. Power Company furnishes and installs the following:
 - 1. Underground primary cable to pad mounted transformer complete with connections at each end.
 - 2. Pad mounted transformer complete.
 - 3. Primary and secondary terminations at the transformer.
- C. The electrical contractor shall furnish and install the following:
 - 1. Primary duct bank as shown on site plan. Duct bank consists of PVC duct as shown on the drawings. Electrical contractor shall confirm that concrete encasement is not required per utility company specifications. See section covering "RACEWAYS". Use long radius, 36" minimum, PVC elbows, same as duct. Terminate ducts as directed by power company.
 - 2. Transformer pad: build transformer pad to power company's specifications. Pad consists of 3000# concrete reinforced with #4 steel bars 12" o.c. in both horizontal directions. Provide 1" x 45-degree chamfer on all top edges. Obtain detail drawings from power. Company for location of anchor bolts, and complete pad details. Pad construction to conform to the power company details. Provide two 3/4" x 10" copper clad steel ground rods in pad as shown.
 - 3. Underground secondary service from transformer consists of conductors in conduit. Terminate conduits inside transformer. Leave necessary slack conductors for secondary connections.
 - 4. Coordinate all service work with power company and install the work in accordance with their requirements and recommendations.

3.3 METERING:

- A. Install devices and conduit for Power Company metering of secondary service as shown. Power Company will furnish meter to Contractor for installation. Install any additional conduit, junction boxes, CT cabinets, etc., as required by Power Company.
- B. Install meter equipment in accordance with Power Company requirements.
- C. Ground meter can in accordance with Power Company Requirements

END OF SECTION 261013

SECTION 261313 - GROUNDING PART 1 - GENERAL

1.1 SCOPE OF WORK: Grounding Details

PART 2 - PRODUCTS

2.1 SYSTEM GROUNDING:

- A. Bond and ground main service neutral, cabinets, equipment, conduits, etc., per the latest edition of NEC.
- B. Ground conductors - 98% conductivity copper, either bare or with green THW insulation. Other conductor requirements same as described for low voltage, 600 volts, conductors.
- C. Ground Connections:
 - 1. Make with mechanical connectors where accessible and with "Cadweld" or approved equivalent where inaccessible.
 - 2. Use high alloy cast copper and/or silicon bronze mechanical connectors with Hex or Allen head bolts where permitted.
 - 3. Use Burndy "GAR" or approved equivalent. Size as required for piping connections.
 - 4. Thoroughly clean prior to installation of clamps and/or lugs.
 - 5. Use bolted or screwed on mechanical connectors. Do not use clip-on connections.
 - 6. Bond ground conductor to metal raceway at each end of the run.
 - 7. Seal connections between dissimilar metals (i.e.: bronze to steel), with approved epoxy resin.
 - 8. Coat connections with "No-OXID-A" compound as manufactured by Dearborn Chemical Company.
- D. Provide lighting and power circuits with green covered ground wire sized per NEC, or as shown, except not smaller than #12 AWG. Bond ground wire to all outlet boxes, junction and pull boxes, cabinets, equipment, etc., with self tapping screw or bolt and appropriate lug. See Section covering "Raceways" for use of grounding bushing.

PART 3- EXECUTION

3.1 EQUIPMENT GROUND 'GREEN WIRE CONCEPT':

- 1. Ground electrical equipment enclosures and conductor enclosures including metal raceways, outlet boxes, cabinets, switch boxes, motor frames, diesel engine frame, transformer cases, and metallic enclosures for all electrical equipment.
- 2. Provide separate grounding conductor for all circuits.
- 3. Install separate ground conductors in heavy wall PVC conduit.
- 4. Bond green wire to equipment enclosure at source and at apparatus served.
- 5. Insulate grounding conductors' size to carry ground fault current safely. Minimum size for green wire grounding lead per N.E.C. Table 250-95, or as indicated.
- 6. Do not use grounded current return conductors (neutrals) for equipment grounding. Connect common grounding lead to supply side of service disconnect unit only.
- 7. Do not ground neutral conductor after it has been grounded at service entrance, transformer or generator.
- 8. Maintain electrical continuity of conduit systems by threaded fittings with joints made-up wrench tight. Install insulated bushing and locknuts on terminating conduits. Provide conduits containing ground wires with grounding bushings bonded to ground wire with short full size jumper.
- 9. Provide receptacles with approved green covered bonding jumper from the grounding

- terminal screw connected to outlet box.
10. Install ground rods in quantity to provide a minimum of 25 ohms ground resistance. Where multiple rods required, separate a minimum of 6 feet and interconnect with wire of ground size shown.
 11. Provide photo documentation in close out documents for pictures of grounding connections of all grounding electrode conductors that are not accessible after construction is completed (Concrete encased electrodes, ground rods at light poles, etc).
 12. Test ground systems as specified in Section "Electrical General".

END OF SECTION 261313

SECTION 262416 - PANELBOARDS PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. Lighting and power panelboards are to be provided by the Electrical Contractor.

PART 2 - PRODUCTS

- A. Panelboards to be constructed in accordance with latest NEMA and UL standards.
- B. Panelboards to be same manufacturer as other distribution equipment.
- C. Panelboard assembly UL labeled, and UL labeled as Service Entrance Equipment where used for that purpose.
- D. Panelboards shall be fully rated to interrupting rating noted on the drawings. Series rating is not permitted.
- E. Bussing:
 - 1. 98% conductivity copper, silverplated at joints or equivalent plated 55% conductivity aluminum.
 - 2. Bus assembly designed for a maximum temperature rise of 55 degree C above 40 degree C ambient temperature when carrying rated current.
 - 3. Minimum thickness of bus bars - 3/32".
 - 4. Bussing braced to withstand a fault current equal to the highest device interrupting capacity in the panel.
 - 5. Neutral bus full size copper or aluminum sized on same basis as phase busses and insulated from the cabinet.
 - 6. Arrange bus bar connections so that adjacent vertical circuit protective devices are consecutively connected to phases A, B, and C throughout panel. Provide 50% capacity ground bus in each panel cabinet, isolated from cabinet and 50% ground bus bolted to cabinet as indicated on Panelboard Schedule.
- F. Cable terminations:
 - 1. Include neutral and ground connections as shown.
 - 2. Make with separate, individual heavy casting aluminum, AL/CU rated lugs, Thomas & Betts, Ilco, Blackburn or approved equivalent.
 - 3. Use 2 bolt tongue or equivalent connection to bus for #1/0 or larger cables.
 - 4. Securely bolt lugs to bus with bolts, nuts and lock washers.
 - 5. Provide double lugs on main bus where shown. Use offset compression lugs as required.
 - 6. Feed through lugs (one set of lugs on each end of main vertical bus) is not acceptable unless approved by Architect.
- G. Circuit breakers:
 - 1. Molded case, thermal magnetic, quick make, quick break, trip free on faults, thermal inverse time delay element and magnetic instantaneous trip coil in each ungrounded phase conductor, or approved equivalent solid state trip unit.
 - 2. Engrave breaker ampere rating on handle or trip unit.
 - 3. Furnish multi-pole breakers with internal common trip
 - 4. Ground fault breakers class "A" type to trip on fault currents of 4-6 ma.
 - 5. Main circuit breakers UL rated for service entrance use.
 - 6. Switch "SWD" rated where required by NEC.

- H. Panelboards classified by type over current protection as follows:
 - 1. BQL Bolted quick lag circuit breaker distribution, 0-100 ampere branches, with minimum interrupting rating as shown on the drawings. Square "D", NQOD.
 - 2. CCB Heavy duty convertible circuit breaker distribution, 0-800 ampere branches with minimum interrupting rating as shown on the drawings. Square "D", I-Line.
- I. All space in panelboards usable. Panelboard space provided with necessary connections for future installation of over current devices.
- J. Identification:
 - 1. Permanently attach nameplates and circuit numbers to panel.
 - 2. Use vertical consecutive circuit numbers for lighting and appliance panels.
 - 3. Provide typewritten circuit directories describing service of each circuit in Type BQL panels.
 - 4. Provide laminated plastic nameplate circuit identification for each circuit in Type CCB panel.
 - 5. Provide each panelboard with nameplate showing name and voltage.
- K. Manufacturers:
 - 1. Panelboards may be by any of the following manufacturers: Square "D", Eaton, Siemens.

2.2 CABINETS: (Same manufacture as interiors)

- A. Code thickness, hot dip galvanized steel or painted with trim and door. Hardware: combination latch and cylinder lock, all keyed the same. Provide celluloid or plastic covered directory card holder on the inside of door. Trim, door and exposed interior shall be finished with factory prime and smooth finish coat of the color selected by Architect. Reinforce cabinets as necessary for service and short circuit rating intended.
- B. Flush or surface as indicated of sufficient size to allow minimum 3" gutter space each side of panel and eight inches (8") at top and bottom, minimum 20" wide. Provide adjustable trim clamp, semi flush hinges and inside rabbet.
- C. Provide panels with continuous hinged trim construction.

PART 3- EXECUTION

3.1 INSTALLATION:

- A. Mount panelboards securely to building structure with 3/8" minimum diameter galvanized bolts and inserts number as required for size of panel, but not less than 4. Mount panelboards with centerline 4'-6" approximately above finished floor. Where panels of different heights are mounted adjacent, install top of panel trim at same height above floor. Close all unused openings.
- B. Where two sets of feeder cables are required in panel gutter space, run one set in each side of panel.

END OF SECTION 262416

SECTION 262726 - SWITCHES AND RECEPTACLES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. Wiring devices and plates and installation.
- B. Switches and Receptacles are to be provided by the Electrical Contractor.

PART 2 - PRODUCTS

2.1 DEVICES:

- A. All devices and covers to be furnished and installed by the electrical contractor as shown on drawings. Catalog numbers establish a standard of quality. Equivalent devices manufactured by Sierra, Arrow Hart, Bryant, Leviton, General Electric or Daniel Woodhead may be used. Submit list of devices with catalog number proposed for review prior to ordering.
- B. Furnish all electrical devices in white unless specified otherwise.

2.2 DEVICE PLATES:

- A. Furnish devices with cover plates. Coverplates shall be white.
- B. Device plates manufactured by Sierra or Hubbell.
- C. Furnish configuration of device plates required for multi-gang installations.
- D. Furnish weatherproof devices with individual gasketed aluminum or stainless steel covers manufactured by Sierra or Hubbell.

PART 3 - EXECUTION

- A. Install receptacles with ground wire from ground screw connected to outlet box.
- B. Install devices vertical unless shown otherwise.
- C. Install receptacles with ground slot up.

END OF SECTION 262726

SECTION 262816 - DISCONNECTS (MOTOR AND CIRCUIT AND SEPARATE CIRCUIT BREAKERS) PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. Safety switches and disconnects and separately mounted circuit breakers are to be provided by the Electrical Contractor.

PART 2 - PRODUCTS

2.1 DISCONNECT SWITCHES:

- A. Heavy duty rated 250 or 600 volts as required; quick-make, quick-break operation; horsepower rated. If switch is not available with proper horsepower rating, classify switch as isolating switch only and provide nameplate reading "DO NOT OPEN UNDER LOAD". Operating handle interlocked with switch door to prevent opening door with switch closed. Provide mechanical over-ride for authorized personnel to open switch door without operating switch handle.
- B. Fusible or non-fusible as shown. Furnish Bussman "low-Peak" fuses for each fusible position, size as shown. Furnish 3 spare fuses for each size.
- C. Furnish with provisions for locking with padlock. Enclosures for switches NEMA 1, general purpose, NEMA 3R, raintight, or special enclosure, as shown.
- D. Standard product of Square "D".

PART 3 - EXECUTION

- A. Secure disconnect switches to building or equipment surface as shown. Where surface is not adaptable for mounting, provide Unistrut P-1000 rack mounted as directed to secure switch.

END OF SECTION 262816

SECTION 269000 - LIGHTING PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. Luminaires and lamps, unless noted otherwise, are to be provided by the contractor. Luminaires shall be as specified in luminaire schedule and as described herein.
- B. Provide shop drawings for all luminaires.

1.2 RELATED SECTIONS:

- A. See Section "Electrical General" for requirement for submittals.

1.3 ABBREVIATIONS:

- A. H.I.D. - High Intensity Discharge (Metal Halide)

1.4 SUBMITTALS:

- A. Shop drawing submittals for luminaires shall include the following for each luminaire: complete construction details including all dimensions, complete description of materials used, complete electrical data (including operating voltage), photometric test report from an independent testing lab, complete description of finish, and manufacturer catalog cutsheet of lamp to be used.

PART 2 - PRODUCTS

2.1 LUMINAIRES:

- A. Locations of luminaires on electrical drawings are diagrammatic. Verify location of luminaires with architectural drawings prior to installation. Conflicts between electrical and architectural drawings shall be referred to the Architect for resolution.
- B. Provide luminaires complete with all options, accessories and other appurtenances required for a complete installation. Contractor shall verify type of ceiling and wall construction being installed, and provide luminaires properly configured for the type of construction.
- C. All luminaires shall be UL listed for the application being installed.
- D. Exit signs shall be furnished with 6" high letters with $\frac{3}{4}$ " stroke. Verify color of signage required by local code authorities. Signs shall meet all NFPA, UL and local building code requirements.
- E. Pendant stem mounted luminaires shall be furnished with ball aligner swivel, 30 degrees from vertical minimum, with swivel below canopy, with $\frac{1}{2}$ " diameter metal tube (stem).
- F. Plastic lenses and shielding shall meet NFPA and local building code requirements for light transmitting plastics.

- G. Metal luminaire housings shall be free of tool marks, dents, burrs and sharp edges. All metal parts shall be painted, galvanized, or otherwise corrosion-resistant.
- H. Reflector surfaces shall be finished specular, semi-specular, diffuse or painted as indicated. Specular finish materials shall have a minimum reflectance value of 83%. Semi-specular or diffuse finish shall have reflectance of 75% and white painted finish materials shall have reflectance of 88%.
- I. Luminaire support wires shall be zinc-coated, soft temper ASTM A641/A641M steel, 12 gage.
- J. Luminaires with aircraft cable suspension system shall use 1/16" diameter (minimum) stainless steel aircraft cable and adjustable cable gripper with swaged cable stop at ceiling canopy. Cable size shall be selected by luminaire manufacturer to provide adequate support.

2.2 BALLASTS AND TRANSFORMERS:

- A. All ballasts and transformers used in luminaires shall be ETL approved and/or UL listed. Transformers for low-voltage lighting systems shall be UL listed for that application.
- B. Interior ballast noise level essentially quiet in normal ambient noise level.
- C. Provide fuse for each ungrounded conductor supplying each ballast or transformer.
 - 1. Fluorescent: provide GMF/HLR fuse of proper size/rating for each ballast.
 - 2. H.I.D.: provide HEB/KTK fuse of proper size/rating for each ballast.
- D. Ballasts provided to function without interruptions when operating in room ambient temperature of 80 degree F. and plenum operating temperature of 120 degree F.
- E. Luminaires installed in environments with ambient temperature below 32 degree F shall be provided with ballast appropriately rated for the ambient environment.
- F. Ballasts for each lamp type shall use a consistent form factor for all luminaires throughout the project using that lamp type.

2.3 FLUORESCENT BALLASTS:

- A. Electronic Ballast Rapid Start, Low THD:
 - 1. Furnish fluorescent luminaires with rapid start lamps and rapid start high-frequency electronic ballasts.
 - 2. Ballast shall be high frequency (20 KHZ or greater) operate lamp without detectable flicker and provide full light output. Ballast shall operate lamp within ANSI guidelines for lamp starting and lamp operation. Ballast shall be warranted for five (5) years. Ballast shall be "Universal Voltage" (able to operate 120V or 277V.) Ballast shall incorporate circuiting to detect "end-of-life" of lamp and shut down ballast operation.
 - 3. Ballast shall comply with FCC and NEMA limits governing EMI and RFI and shall not interfere with the operation of other electrical equipment. Total Harmonic Distortion shall be less than 10%. Power Factor shall be greater than 0.98%. Ballast/lamp system shall meet the following (T8 lamps are used to establish level of performance. Provide ballast required to properly operate lamp specified in luminaire schedule or as required by luminaire manufacturer):

a. <u>T8 Lamps:</u>		
<u>Configuration</u>	<u>Ballast Factor</u>	<u>Ballast Efficacy Factor</u>
2-Lamp	.88	1.45
3-Lamp	.86	.92

- b. Approved Ballast Manufacturers:
 - 1) Advance, Universal, or Osram/Sylvania, ESI.

2.4 COMPACT FLUORESCENT BALLASTS:

- A. Electromagnetic Ballast (13 watt or less):
 - 1. Compact fluorescent luminaires with pre-heat type lamps (integral starter) shall be furnished with compatible electromagnetic ballasts.
 - 2. Ballast shall be equipped with UL recognized non-PCB containing capacitor, and a core and coil protector. Ballast shall be high power factor, UL listed Class P, and shall operate lamps within ANSI guidelines for lamp starting and operation.
- B. Electronic Ballast (13 watt and higher):
 - 1. Compact fluorescent luminaires with rapid start lamps (without integral starter) shall be furnished with programmed rapid start electronic ballasts.
 - 2. Ballasts shall be series wired, THD<10%, minimum starting temperature of 0°F, maximum case temperature of 70°C, and allow remote mounting up to 18 feet. Ballast factor to be 0.95 –1.05 for Normal Light Output. Ballast input voltage shall be Universal Voltage (120V through 277V).
 - 3. "Triple-tube" (aka. PLT, "hex" tube, or CFM) compact fluorescent lamps shall be furnished with electronic ballast that will operate 26, 32, or 42 watt lamps.
 - 4. Approved ballast manufacturers: Advance, ESI, Universal, Robertson, Osram/Sylvania.

2.5 HIGH INTENSITY DISCHARGE BALLASTS:

- A. Metal Halide:
 - 1. Furnish Metal Halide luminaires with Auto-Regulating or Constant-Wattage Auto transformer ballast. Ballast shall be high power factor (PF > 0.9) and operate lamp within ANSI standards for lamp starting and operation. Ballast shall regulate lamp power within 10% with line voltage variation of +/- 10% and shall keep lamp energized with line voltage drop not exceeding 30%.
 - 2. Furnish pulse start luminaire / lamp system where indicated. Pulse start ballasts shall be linear-reactor on super CWA type.
- B. Approved HID Ballast Manufacturers:
 - 1. Advance, Universal, Valmont, Venture.

2.6 LAMPS:

- A. Furnish lamps for all luminaires as specified in Luminaire Schedule, otherwise provide lamp as recommended by luminaire manufacturer.
- B. Lamps shall be new, delivered to the project site in their original packing, and shall be of the same manufacturer for each luminaire type. Install lamps immediately prior to Owner's occupancy. Do not use lamps for construction purposes.
- C. Warranty lamps as follows:
 - 1. Incandescent - one month.
 - 2. Fluorescent and HID - one year
 - 3. Warranty begins from date of substantial completion.
 - 4. All lamps shall be free of defects and covered by an implied warranty based on industry - accepted lamp mortality. Lamps failing at a higher than normal rate shall be replaced upon determination of cause of failure or defeat.

- D. Incandescent lamps:
 - 1. Standard Shape A-lamp shall be medium base, 130 volt rated, inside frosted.
- E. Fluorescent Lamps:
 - 1. All fluorescent and compact fluorescent lamps shall be compatible with ballast provided with luminaires to operate lamp within ANSI and NEMA guidelines. Provide lamps with low mercury content (federal EPA TCLP compliant a.k.a. "ECO" or "ALTO").
 - 2. T8 lamp type: lamps shall have an average rated life of 20,000 hours, minimum of 2800 lumens and 75 CRI.
 - 3. Compact fluorescent (T4) lamp type: Compact fluorescent lamps shall either be single, double or triple tube type with 4-pin bases for operation on electronic and dimming ballasts. Where available lamps shall contain end-of-life sensing to prevent overheating of lamp base and sockets. Lamps shall have a minimum CRI of 82.
 - 4. Compact fluorescent (T5) lamp type: Lamps shall have a 2G11 base and operate on electronic ballasts. Lamps shall have a minimum CRI of 82.
- F. High Intensity Discharge (HID) Lamps:
 - 1. All high intensity discharge lamps shall be operated on the appropriate ANSI designated electromagnetic ballast in accordance with ANSI C82.4.
 - 2. Metal halide lamps: All metal halide lamps used in interior applications shall be coated, unless otherwise noted in the lighting fixture schedule. Otherwise, provide clear or coated lamp as recommended by luminaire manufacturer. All metal halide lamps used in open aperture luminaire shall contain a protective shroud / other suitable containment material for use in open fixtures ("O" rated).
- G. Approved Lamp Manufacturers:
 - 1. General Electric, Osram/Sylvania, Philips, Venture.

2.7 EMERGENCY LIGHTING:

- A. Provide luminaires and exit signs with self-contained battery power supplies as indicated. All equipment shall conform to UL924-Emergency Lighting and Power Equipment.
- B. Battery shall be sealed, maintenance-free lead-acid type (indoors) or nickel-cadmium (outdoors or unconditioned spaces) with 10-year nominal life. Unit shall incorporate a fully-automatic solid state charger and automatic transformer relay to transformer to backup battery power supply upon failure of normal power.
- C. Fluorescent emergency ballasts shall be self-contained battery-inverter units mounted within the luminaire housing. In emergency operation, lamps shall operate continuously for a minimum of 90 minutes. Once normal power is restored, the unit shall automatically transfer to charging mode. The ballast shall produce light output (minimum) as follows:
 - 1.

<u>Lamp Type</u>	<u>Lumen Output</u>
F32T8	1350 Lumens
FT40	900 lms
CFM42W/32W	750 lms
CFQ26W	600 lms
- D. All emergency lighting equipment shall be equipped with means to test operation and an LED indicating battery status.

2.8 POLES AND STANDARDS:

- A. Poles should conform to AASHTO LTS-3 standards for structural design. Poles shall be designed to withstand prevailing wind conditions with a gust factor of 1.3.
- B. Pole manufacturer shall coordinate with luminaire manufacturer to ensure adequate strength to support the fixtures specified. Pole shall be furnished with all appropriate mounting hardware, fasteners and supports for installation of the luminaire(s).
- C. All pole hardware and fasteners shall be stainless steel or other corrosion-resistant materials if stainless steel is not compatible with structural material.
- D. Pole manufacturer shall provide a plywood or steel anchor-bolt template to assist installer in preparing pole foundation. Template shall indicate luminaire orientation to ensure proper light distribution.
- E. Provide power-installed screw foundation where indicated. Screw foundation shall be fabricated with hot-dip galvanized structural steel (ASTM A36/A36M) of sufficient strength to support pole and luminaire. Mounting plate and bolts shall be coordinated to match pole.
- F. All poles shall be provided with a wiring handhole per National Electrical Code requirements.
- G. All poles shall be provided with grounding lug bonded to metal components of the pole. The lug shall be accessible through the handhole.
- H. All poles shall be furnished with anchor bolt/base plate covers. Cover shall match pole match pole material and finish.
- I. Steel poles shall be pre-finished inside and out, either hot-dip galvanized or prime-coat enamel to prevent corrosion.

PART 3 - EXECUTION

- A. Support luminaires from structure of the building, independent from the ceiling membrane or finish material. Luminaire shall be set level, plumb, and square with ceilings and walls.
- B. Recessed lay-in luminaires in suspended grid ceilings shall be supported from the ceiling grid. Provide devices for securing the luminaire to the ceiling grid to comply with the National Electrical Code ("earthquake clips"). Luminaires heavier than 30 pounds shall have supplemental support wires anchored to the structure above the ceiling. Provide independent support wires, anchored to structure above and attached to fixture at each corner.
- C. Recessed luminaires in fire-rated ceiling assemblies shall be installed in accordance with the UL listing of the assembly.
- D. Recessed luminaires (non lay-in or hard ceiling types) shall be supported by $\frac{3}{4}$ " steel ceiling channel, or factory-supplied hanger bars one on each side of the luminaire, anchored to ceiling structure. Recessed luminaires heavier than 20 pounds shall have supplemental support anchored to the structure above the ceiling. Do not use conduit to support luminaire.
- E. Provide recessed luminaires with appropriate frames, hardware and trim for the ceiling installed.
- F. Install luminaires free and clear of structural and mechanical interferences above the ceiling. If location indicated on the drawing conflicts with other elements, notify the Architect for directions for remedial action.

- G. Attach surface and pendant mounted luminaires to 3/16" fixture stud in outlet box. Luminaires in excess of 20 pounds shall have supplemental support anchored to the structure above the ceiling.
- H. Luminaires surface mounted to grid-type ceilings shall be mounted with Caddy IDS type clips anchored to structure above.
- I. Wall mounted luminaires shall be anchored to wall structure. Luminaire shall fully conceal the outlet box.
- J. Wiring to luminaires shall be with flexible metallic conduit to junction box. Do not wire luminaire to luminaire unless noted otherwise, or if using manufactured wiring systems.
- K. Individual flexible connections under 6 feet in length shall consist of 2#14 and 1#14 (ground) in 3/8" flexible metallic conduit (for circuits 20A or less). Bond ground wire and conduit at each end.
- L. Recessed luminaires in insulated ceilings shall be installed so that insulation is no less than 3 inches away from the fixture enclosure unless the luminaire is listed for direct contact with insulation (IC rated).
- M. Provide equipment, labor and materials, as needed for final aiming of adjustable luminaires. Aiming shall take place immediately before final occupancy by the Owner.
- N. Exterior pole-mounted luminaire with anchor base type poles shall be installed on a reinforced concrete foundation designed to withstand fixture weight and prevailing wind conditions. Conduit raceway shall be pre-set in the foundation and terminate inside the pole.
- O. Provide a copper-clad steel grounding rod, installed and bonded at each lighting pole.
- P. Exterior pole-mounted luminaires with direct-embedment type poles shall be installed in carefully compacted earth per pole manufacturer's recommendations.
- Q. All poles shall be installed so that the pole is plumb to the earth, with the bottom of the base flush to the foundation, paving, or finished grade, unless indicated otherwise. Verify soil conditions at each pole location to ensure adequacy of soil to support pole. Advise Architect if soil conditions are not adequate.
- R. All pole-mounted luminaires shall have in-line fuse installed at the hand hole of the pole with weatherproof fuse holder. Provide sufficient slack in conductors to allow servicing outside of pole.
- S. Reflectors, trim cones, and other visible trim of luminaires shall not be installed until completion of ceiling work, and shall be clean and free of dust, fingerprints, scratches, dents etc. upon substantial completion.

END OF SECTION 269000

SECTION 270528 - TELEPHONE SYSTEM PART 1 - GENERAL

1.1 SCOPE OF WORK:

- A. Telephone system consists of conduits, raceways, boxes, outlets, wiring and terminal boards.

PART 2 – PRODUCTS

- A. See "RACEWAYS" specification for raceways.
- B. See "OUTLETS" specification for boxes and outlets.
- C. All products shall be UL listed for their use.

PART 3 - EXECUTION

3.1 TELEPHONE ENTRANCE:

- A. Install entrance conduit as shown on drawings.

3.2 CONDUIT:

- A. Interior conduit EMT, minimum 3/4" unless noted otherwise. 2" size and larger - use screw indenter type fittings.
- B. Conduit homeruns - minimum 1" unless otherwise noted.
- C. Conduit to extend from wall and floor outlets and terminate with a bushing at backboard as shown on the plans.
- D. All conduit shall have #14 iron fish wire or nylon pullcord for the wiring installation.

3.3 TERMINAL BACKBOARD:

- A. Terminal backboard constructed of high density, commercial grade pressboard, securely fastened to wall. Entire assembly painted with two coats of blue paint.

3.4 OUTLETS:

- A. Provide outlets with blank device plate, except where telephone terminal is installed.

3.5 WIRING:

- A. Wiring shall be as specified on the drawings.

END OF SECTION 270528

SECTION 281100 - SECURITY SYSTEM PART1 - GENERAL

1.1 SCOPE OF WORK:

- A. Security System consists of empty conduits, raceways, boxes, and outlets.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 EMPTY CONDUIT:

- A. Interior conduit EMT, minimum 3/4" unless noted otherwise. 2" size and larger -use screw indentor type fittings.
- B. Conduit homeruns - minimum 3/4" unless otherwise noted.
- C. Conduit to extend from wall and floor outlets and terminate with a bushing at backboard as shown on the plans.
- D. All conduit shall have #14 iron fish wire or nylon pullcord.
- E. Confirm final location of all security products prior to the installation of the raceways, boxes, outlets, and empty conduits.

3.2 OUTLETS:

- A. Provide outlets with blank device plate, except where security panel is installed.

END OF SECTION 281100

SECTION 283111 - ALTERATIONS AND ADDITIONS TO EXISTING FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and General Provisions of Contract including General and Supplementary Conditions and other Division 1 Specifications apply.

1.2 RELATED SPECIFICATION SECTIONS:

Section 260500.....	Electrical General
Section 260533	Raceways
Section 260536	Outlet Boxes
Section 262416.....	Panelboards

1.3 DESCRIPTION OF WORK:

- A. This section covers the furnishing, installation and testing of a complete Alterations and Additions to existing Fire Alarm System which includes actuation devices, notification appliances, and actuation devices which cause other Code or operations functions to occur, such as air handling unit shut down and fire door/shutter operations.
- B. This section requires all conduit and wiring to support complete Fire Alarm System. Drawings do not show conduit and wiring requirements. This information is to be supplied to Contractor by Fire Alarm Supplier, both prior to bids for inclusion in pricing and specifically in Shop Drawing.
- C. Contractor is required to review all Contract Documents for connections of other systems to Fire Alarm for Code required operations. Items such as held-open fire/smoke doors, smoke/fire dampers, elevator recall, hood suppression system, smoke evacuation fans, etc. are a part of the fire alarm system.

1.4 SYSTEM OPERATION:

- A. System non-coded, general alarm.
- B. Electrically supervise system against both short and open wiring faults in detection circuits, alarm circuits, and internal control panel faults. Short or open wiring faults occurring in circuits will cause audible and visual trouble indication at control panel.
- C. System functions as follows when an actuation device is initiated:
 - 1. Audible alarm devices will sound continuously. Visual alarm devices will flash.
 - 2. Proper zone and fire indications will appear on main control panel and remote annunciators.
 - 3. Circuits to energize or de-energize equipment power control circuits will be actuated as indicated. Shut down HVAC Equipment.
 - 4. Digital communicator will notify the monitoring service if connected.
 - 5. Closing of sprinkler valve will cause audible and visual signal at Annunciator(s), but will not initiate Fire Alarm.

6. Actuation of sprinkler flow valve will initiate system.

1.5 MANUFACTURER'S REQUIREMENTS:

- A. System shall be supplied, installation supervised and tested by an Authorized Factory Dealer located within seventy (70) miles of project site. Submit evidence of same with Shop Drawings.
- B. Submit complete Shop Drawings of system for review including terminal-to-terminal connection diagram, conduit diagrams, technical information on each item of equipment, and any other information required to describe system. Identify color code and terminal numbers on Shop Drawings.
- C. Manufacturer's trained Technical Representative shall supervise installation, connections, and test. Before acceptance, Manufacturer's Representative will certify in writing system is installed and functioning properly as intended by Drawings, Specifications, and Code. Test include operation of all devices.
- D. Guarantee system in writing for one (1) year from date of acceptance. Guarantee covers parts and labor.

1.6 CODES:

- A. The Fire Alarm Systems shall comply with requirements of NFPA Standard No. 72 and NFPA 70, Article 760 for protected premises signaling systems, except as modified and supplemented by this Specification. The system shall be supervised either electrically, or by software-directed polling of field devices.
- B. The system shall also be listed by Underwriter's Laboratories under the category Control Unit System (UOJZ) and Control Unit Accessories (UOXX).
- C. The Fire Alarm System shall be manufactured by an ISO 9001 certified company and meet the requirements of BS EN9001 and ANSI/ASQC Q9001-1994.
- D. System shall comply with all local Codes. Modification of design to meet same is required and no additional compensation will be allowed for compliance. See execution section for devices to assist in this.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Entire system shall be the product of existing system manufacturer, no exception.
- B. Specifications list product numbers.

2.2 SYSTEMS:

- A. System shall consist of modifications and additions to main control panel complete with increased batteries and charger to support system operation and all required components required by system expansion and factory installed surge suppression on power input.
- B. System Components:
 - 1. Existing System Control Panel:

- a Communication module for remote monitoring and built-in surge suppressor on power feed.

2. Main Control Panels:

- a Mount all new devices in existing enclosure to prewired existing panel to terminal strips or to additions in new metal enclosure with prewired terminal strips..
- b Construct cabinets of 14 gage steel with baked paint finish.
- c Identify all devices, relays, circuit cards, etc., as to function with permanent identification.
- d Furnish function modules as follows:
 - (1) Zone Modules: Class "B" power limited; 24 volt DC, for N.O. initiating devices; two (2) initiating circuits per module; (to power detectors from initiating circuit); annunciated alarm and trouble indication; lamp (LED) test; SPDT alarm operated contact; SPDT trouble operated contact. Furnish modules for total zones (zones as shown on drawings) plus seven (7) spare zones.
 - (2) System Trouble Module: Parallel 24 volts DC; open and short supervision; visual trouble indication. Furnish signal modules as required to power all signal devices shown. Provide trouble audible silence switch with trouble resound.
 - (3) March Time Module: 120 beats per minute to flash visual alarm devices.
 - (4) Upgrade Signal Circuit Module: Class B operation, to power electrically new and existing supervised signals, 24 volts, provide alarm silence switch with trouble resound, provide separate circuitry for horns and lights.
 - (5) Rooftop unit shutdown with auxiliary contact in detector.
 - (6) Battery Charger / Transfer Module: Dual rate charger, automatic trickle charge, manual high rate charge; D.C. voltmeter and ammeter; low battery alarm, "on-battery" "indication" automatic transfer switch to supply fire alarm system from battery on failure of incoming 120 volt AC power.
 - (7) Batteries: Sealed, rechargeable, gelled electrolyte, 30 ampere hours based on 20 hour discharge rate, "Gel-cell" or equal. Mount in control panel cabinet.

3. Initiation Modules:

- a Manual pull station, addressable, double action, break glass; _____
- b Heat detectors, addressable rate of rise for normal temperature application 135° fixed with 15° rate of rise.
- c Heat detectors, addressable rate of rise high temperature application 155° fixed with 15° rate of rise.

- d Smoke detector, photo-electric addressable. Use detector suitable for area where applied outdoors.
- e Duct detector, photo-electric, with sampling tubes, housing, and remote status/test station with progressable relay for air handling unit shut down.
 - (1) Appropriate length sampling tubes.
 - (2) For air conditioning units 2000 CFM and larger or where shown.
 - (3) Monitor module, addressable, to monitor devices internal to Fire Alarm such as hood fire suppression panel, fire pump operation, generator running, etc.
 - (4) Control module, addressable, to operate (turn ON or OFF) external devices such as trip elevator breaker, etc.
- f Flame Detectors:
 - (1) Responds to infra-red radiation, plug-in, adjustable sensitivity and time delay; surface or flush mounted as shown with addressable monitor module.
- g Sprinkler Flow Switch:
 - (1) Connection only to switch installed by others.
- h Where Manufacturer model numbers are not mentioned, use standard published device (modified as required by Specification) of existing manufacturer complying with Specifications of item described.

2.3 ALARM INDICATING DEVICES:

A. Strobe Alarm Lights:

- 1. White lens mounted in faceplate (to meet ADA requirements), rated 24 VDC; 75 candela minimum lamps; electrically supervised, identified with lettering "FIRE" on unit.

B. Strobe Light/Horn:

- 1. 75 candela minimum power lamp horn; 87 dba at 10 feet; in one faceplate.

C. Strobe Light/High Output Horn:

- 1. 75 candela minimum power lamp horn

D. Where Manufacturer's model is not indicated for alarm devices, use system Manufacturer's standard published device which complies with Specification.

2.4 MISCELLANEOUS DEVICES:

A. Sprinkler Valve Supervisory Switch/Valve Supervisory Switches:

- 1. Shall be provided and wired by the Electrical Contractor under this section. Valve switches shall be suitable for the application O, S & Y, or PTV Type and shall mount

to the valve.

- B. Knox Box: 4400 with wiring for monitoring circuit.

PART 3 - EXECUTION

3.1 COMPLETE SYSTEM REQUIREMENTS:

- A. Review entire control documents for items requiring connection to or operation by the fire alarm system to meet and comply with all local and national codes. This includes Architectural, HVAC, Plumbing, and Fire Protection.

3.2 SUBMITTALS:

- A. After review of documents prepare shop drawings as described. Including items not shown on drawings.
- B. Submit shop drawings to local building authorities for their review and approval. Incorporate review comments prior to submission to engineer for review.
- C. Submit Shop Drawings consisting of, but not necessarily limited to, the following:
 - 1. 1/8 inch scale floor plans showing all devices; the required type and number of conductors with conduit size.
 - 2. Plans shall specifically cover:
 - a. Initiation of system by manual pull stations and automatic functions such as smoke detectors, heat detectors, flame detectors.
 - b. Initiation of system by kitchen hood fire protection system(s).
 - c. Initiation of system by elevator smoke and heat detectors and elevator recall and power shut down.
 - d. Initiation of systems by sprinkler system flow valves and trouble signal by sprinkler system supervisory switch.
 - e. Unlocking of electrically controlled exit and internal egress doors.
 - f. Each visual device shall be furnished with candela requirements for application with candela power shown by device.
 - g. Each audible device shall be furnished with Db rating required for application with Db rating shown by device.
 - 3. Where review of all contract documents and/or local Codes require devices not shown, use devices listed in Attic Stock to supplement drawings. If Attic Stock is exceeded, notify Architect in Shop Drawing submittal.
 - 4. Elevation of "Fire Alarm Control Panel" (central control station), and each transponder with location of each component and Manufacturer's descriptive cutsheet of that component. Provide wiring diagrams of control panel.
 - 5. Power / Battery Calculations.

6. Submit shop drawing to local Code Official for review and approval prior to submission to Engineer for review.
7. Shop drawings shall bear approval of authority or some other verification method to sustain review.
8. Shop drawing shall also bear stamp of review by Electrical Contractor.
9. Manufacturer's descriptive cutsheet of each initiation device, audible or visual signal and outlet box requirements for mounting. Provide symbol on cutsheet matching that shown on drawing for that device.

3.3 GENERAL REQUIREMENTS:

- A. Furnish and install conduit, outlet boxes, back boxes, junction boxes, terminal cabinets, accessories, wiring connections, etc., required for a complete system as intended by these Specifications, and in accordance with the Manufacturer's recommendation for the equipment supplied.
- B. The conduit and wiring requirements shall be furnished by the Manufacturer's Representative, and he shall, prior to bidding. Inform all Contractors of requirements which shall be included in the bid for this system.
- C. All Fire Alarm wiring shall be put in plenum type cable above accessible ceilings and in exposed ceiling areas. Where ceilings are not accessible, run wiring in conduit. Wall mounted devices shall be installed on outlet box with wiring in conduit, concealed in wall, and stubbed into ceiling.
- D. All Fire Alarm conductors shall be #14 AWG minimum with type "XHHW", "THWN", or "THHN" insulation. Conductors shall be color coded in an approved manner. Each conductor shall be identified with T&B "E-Z" code markers at each device connection, each splice location, each junction box and terminal cabinet, and in the main control panel and remote annunciator.
- E. Multiplex system wiring for Communication channels (2):
 1. Two (2) 2/C #18 twisted shield cable; Belden #8760, or as recommended by Manufacturer.
- F. Provide Fire Alarm System junction boxes ("FJ") as indicated. Junction boxes shall have painted red enamel covers with "FA" on small covers "FIRE ALARM" on large covers in 1 inch high white letters. Splices in junction boxes made on identified terminal strips.
- G. Provide terminal cabinets ("FT") where indicated, size as required, complete with identified terminal strips, quantity as required for number of wires entering cabinet. The cabinets shall be flush or surface mounted as indicated with full height piano hinged door with cylinder lock, keyed same as control panel. Finish shall be white enamel inside with red enamel outside. Install engraved plastic nameplate on cabinet door to identify cabinet as indicated in 1/4 inch high red letters on white background. Attach nameplate with two (2) small screws.

END OF SECTION

SECTION 283111 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes fire alarm systems.

1.03 DEFINITIONS

- A. FACP: Fire alarm control panel.
- B. LED: Light-emitting diode.
- C. NICET: National Institute for Certification in Engineering Technologies.
- D. Definitions in NFPA 72 apply to fire alarm terms used in this Section.

1.04 SYSTEM DESCRIPTION

- A. Non-coded, addressable and networkable system; multiplexed signal transmission dedicated to fire alarm service only.

1.05 PERFORMANCE REQUIREMENTS

- A. Comply with NFPA 72.
- B. Fire alarm signal initiation shall be by one or more of the following devices:
 - 1. Manual stations.
 - 2. Heat detectors.
 - 3. Smoke detectors.
 - 4. Automatic sprinkler system water flow.
 - 5. Fire standpipe system.
 - 6. Kitchen hood fire protection system activation.
- C. Fire alarm signal shall initiate the following actions:
 - 1. Alarm notification appliances shall operate continuously.
 - 2. Activate voice/alarm communication system.
 - 3. Identify alarm at the FACP and remote annunciators.
 - 4. Transmit an alarm signal to the remote alarm receiving station.
 - 5. Unlock electric door locks in designated egress paths.
 - 6. Release doors held open by magnetic door holders.
 - 7. Recall elevators to primary or alternate recall floors.
 - 8. Switch heating, ventilating, and air-conditioning equipment controls to fire alarm mode.
 - 9. Record events in the system memory.

- D. Supervisory signal initiation shall be by one or more of the following devices or actions:
 - 1. Operation of a fire-protection system valve tamper.
- E. System trouble signal initiation shall be by one or more of the following devices or actions:
 - 1. Open circuits, shorts and grounds of wiring for initiating device, signaling line, and notification-appliance circuits.
 - 2. Opening, tampering, or removal of alarm-initiating and supervisory signal-initiating devices.
 - 3. Loss of primary power at the FACP.
 - 4. Ground or a single break in FACP internal circuits.
 - 5. Abnormal ac voltage at the FACP.
 - 6. A break in standby battery circuitry.
 - 7. Failure of battery charging.
 - 8. Abnormal position of any switch at the FACP or annunciator.
- F. System Trouble and Supervisory Signal Actions: Annunciate at the FACP and remote annunciators.

1.06 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
 - 1. Shop Drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by manufacturer in fire alarm system design.
 - b. Fire alarm certified by NICET, minimum Level III.
 - 2. System Operation Description: Detailed description for this Project, including method of operation and supervision of each type of circuit and sequence of operations for manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are not acceptable.
 - 3. Device Address List: Coordinate with final system programming.
 - 4. System riser diagram with device addresses, conduit sizes, and cable and wire types and sizes.
 - 5. Wiring Diagrams: Power, signal, and control wiring. Include diagrams for equipment and for system with all terminals and interconnections identified. Show wiring color code.
 - 6. Batteries: Size calculations.
 - 7. Duct Smoke Detectors: Performance parameters and installation details for each detector, verifying that each detector is listed for the complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
 - 8. Ductwork Coordination Drawings: Plans, sections, and elevations of ducts, drawn to scale and coordinating the installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, the detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
 - 9. Floor Plans: Indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.
- C. Qualification Data: For Installer.
- D. Operation and Maintenance Data: For fire alarm system to include in emergency, operation, and maintenance manuals. Comply with NFPA 72, Appendix A, recommendations for Owner's manual. Include abbreviated operating instructions for mounting at the FACP.

- E. Submittals to Authorities Having Jurisdiction: In addition to distribution requirements for submittals specified in Division 1 Section "Submittals," make an identical submittal to authorities having jurisdiction. To facilitate review, include copies of annotated Contract Drawings as needed to depict component locations. Resubmit if required to make clarifications or revisions to obtain approval. On receipt of comments from authorities having jurisdiction, submit them to Architect for review.
- F. Documentation:
 - 1. Approval and Acceptance: Provide the "Record of Completion" form according to NFPA 72 to Owner, Architect, and authorities having jurisdiction.
 - 2. Record of Completion Documents: Provide the "Permanent Records" according to NFPA 72 to Owner, Architect, and authorities having jurisdiction. Format of the written sequence of operation shall be the optional input/output matrix.
 - a. Hard copies on paper to Owner, Architect, and authorities having jurisdiction.
 - b. Electronic media may be provided to Architect and authorities having jurisdiction.

1.07 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project and NICET Level III certified.
- B. 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.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturer/Model:
 - 1. Standalone new branch building - Edwards Model number EST IO64-GD no exceptions
 - 2. New branch inside existing building – If no existing fire alarm, Edwards Model number EST IO64-GD no exceptions. If building has existing system, match existing manufacturer.

2.02 FACP

- A. General Description:
 - 1. Modular, power-limited design with electronic modules, UL 864 listed.
 - 2. Addressable initiation devices that communicate device identity and status.
 - a. Smoke sensors shall additionally communicate sensitivity setting.
 - b. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.
 - 3. Addressable control circuits for operation of mechanical equipment.
- B. Alphanumeric Display and System Controls: Arranged for interface between human operator at the FACP and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
 - 1. Annunciator and Display: Liquid-crystal type, three line(s) of 80 characters, minimum.

2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.
- C. Circuits:
1. Signaling Line Circuits: NFPA 72, Class B, Style 4.
 - a. System Layout: Install no more than 25 addressable devices on each signaling line circuit.
 2. Notification-Appliance Circuits: NFPA 72, Class A, Style Z.
 3. Actuation of alarm notification appliances, emergency voice communications, annunciation, elevator recall, and actuation of suppression systems shall occur within 10 seconds after the activation of an initiating device.
 4. Electrical monitoring for the integrity of wiring external to the FACP for mechanical equipment shutdown and magnetic door-holding circuits is not required, provided a break in the circuit will cause doors to close and mechanical equipment to shut down.
- D. Notification-Appliance Circuit: Operation shall sound in a temporal pattern, complying with ANSI S3.41.
- E. Voice/Alarm Signaling Service:
1. Provide for automatic transmission of announcements or for manual transmission of announcements by use of the central-control microphone. Amplifiers shall comply with UL 1711 and be listed by an NRTL.
 - a. Programmable tone and message sequence selection.
 - b. Standard digitally recorded messages for "Evacuation" and "All Clear."
 - c. Generate tones to be sequenced with audio messages of type recommended by NFPA 72 and that are compatible with tone patterns of notification appliance circuits of fire-alarm control unit.
 2. Preamplifiers, amplifiers, and tone generators shall automatically transfer to backup units, on primary equipment failure.
- F. Elevator Controls: Heat detector operation shuts down elevator power by operating a shunt trip in a circuit breaker feeding the elevator.
- G. Power Supply for Supervision Equipment: Supply for audible and visual equipment for supervision of the ac power shall be from a dedicated dc power supply, and power for the dc component shall be from the ac supply connected to the emergency power system.
- H. Alarm Silencing, Trouble, and Supervisory Alarm Reset: Manual reset at the FACP after initiating devices are restored to normal.
1. Silencing-switch operation halts alarm operation of notification appliances and activates an "alarm silence" light. Display of identity of the alarm zone or device is retained.
 2. Subsequent alarm signals from other devices or zones reactivate notification appliances until silencing switch is operated again.
 3. When alarm-initiating devices return to normal and system reset switch is operated, notification appliances operate again until alarm silence switch is reset.
- I. Walk Test: A test mode to allow one person to test alarm and supervisory features of initiating devices. Enabling of this mode shall require the entry of a password. The FACP and annunciators shall display a test indication while the test is underway. If testing ceases while in walk-test mode, after a preset delay, the system shall automatically return to normal.
- J. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signal, supervisory signal supervisory and

digital alarm communicator transmitter and digital alarm radio transmitter shall be powered by the 24-V dc source.

1. The alarm current draw of the entire fire alarm system shall not exceed 80 percent of the power-supply module rating.
2. Power supply shall have a dedicated fused safety switch for this connection at the service entrance equipment. Paint the switch box red and identify it with "FIRE ALARM SYSTEM POWER."

K. Secondary Power: 24-V dc supply system with batteries and automatic battery charger and an automatic transfer switch.

1. Batteries: Sealed lead calcium.
2. Battery and Charger Capacity: Comply with NFPA 72.

L. Surge Protection:

1. Install surge protection on ac power for the FACP and its accessories. Comply with Section 264313 "Transient Voltage Suppression" for auxiliary panel suppressors.
2. Install surge protectors recommended by FACP manufacturer. Install on all system wiring external to the building housing the FACP.

M. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

N. Enclosure finish shall be white paint.

2.03 MANUAL FIRE ALARM BOXES

- A. Description: UL 38 listed; finished in red with molded, raised-letter operating instructions in contrasting color. Station shall show visible indication of operation. Mounted on recessed outlet box; if indicated as surface mounted, provide manufacturer's surface back box.
1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type. With integral addressable module, arranged to communicate manual-station status (normal, alarm, or trouble) to the FACP.
 2. Station Reset: Key- or wrench-operated switch.

2.04 SYSTEM SMOKE DETECTORS

A. General Description:

1. UL 268 listed, operating at 24-V dc, nominal.
2. Multipurpose type, containing the following:
 - a. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
 - b. Piezoelectric sounder rated at 88 dBA at **10 feet** according to UL 464.
 - c. Heat sensor, combination rate-of-rise and fixed temperature.
3. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. Provide terminals in the fixed base for connection of building wiring.
4. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.

5. Integral Visual-Indicating Light: LED type. Indicating detector has operated and power-on status.

B. Photoelectric Smoke Detectors:

1. Sensor: LED or infrared light source with matching silicon-cell receiver.
2. Detector Sensitivity: Between 2.5 and 3.5 percent/foot smoke obscuration when tested according to UL 268A.

C. Ionization Smoke Detector:

1. Sensor: Responsive to both visible and invisible products of combustion. Self-compensating for changes in environmental conditions.
2. Detector Sensitivity: Between 0.5 and 1.7 percent/foot smoke obscuration when tested according to UL 268A.

D. Duct Smoke Detectors:

1. Photoelectric Smoke Detectors:

- a. Sensor: LED or infrared light source with matching silicon-cell receiver.
 - b. Detector Sensitivity: Between 2.5 and 3.5 percent/foot smoke obscuration when tested according to UL 268A.
2. UL 268A listed, operating at 24-V dc, nominal.
 3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
 4. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. The fixed base shall be designed for mounting directly to the air duct. Provide terminals in the fixed base for connection to building wiring.
 5. Self-Restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.
 6. Integral Visual-Indicating Light: LED type. Indicating detector has operated and power-on status. Provide remote status and alarm indicator and test station for each duct detector located where accessible from floor level.
 7. Each sensor shall have multiple levels of detection sensitivity.
 8. Sampling Tubes: Design and dimensions as recommended by manufacturer for the specific duct size, air velocity, and installation conditions where applied.
 9. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.
 10. A/V theatrics system will use fog/haze-producing effects. Adjust duct detector installation to account for this.

2.05 HEAT DETECTORS

A. General: UL 521 listed.

B. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F. Detectors for elevator power-disconnect system may require lower temperature rating.

1. Mounting: Plug-in base, interchangeable with smoke detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.

2.06 NOTIFICATION APPLIANCES

- A. Description: Equipped for mounting as indicated and with screw terminals for system connections. Housings shall be white thermoplastic
 - 1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly.
- B. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn.
- C. Visible Alarm Devices: Xenon strobe lights listed under UL 1971, with clear or nominal white polycarbonate lens. The word "FIRE" is engraved on the lens. Synchronize strobes located in the same area.
 - 1. Rated Light Output: 75 candela unless otherwise noted.
 - 2. Strobe Leads: Factory connected to screw terminals.
- D. Voice/Tone Notification Appliances:
 - 1. Appliances shall comply with UL 1480 and shall be listed and labeled by an NRTL.
 - 2. High-Range Units: Rated 2 to 15 W.
 - 3. Low-Range Units: Rated 1 to 2 W.
 - 4. Mounting: semi recessed or surface mounted and bidirectional.
 - 5. Matching Transformers: Tap range matched to acoustical environment of speaker location.

2.07 MAGNETIC DOOR HOLDERS

- A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.
 - 1. Electromagnet: Requires no more than 3 W to develop 25-lbf holding force.
 - 2. Wall-Mounted Units: Flush mounted, unless otherwise indicated.
 - 3. Rating: 24-V ac or dc.
- B. Material and Finish: Match door hardware.

2.08 ADDRESSABLE INTERFACE DEVICE

- A. Description: Microelectronic monitor module listed for use in providing a system address for listed alarm-initiating devices for wired applications with normally open contacts.
- B. Integral Relay: Capable of providing a direct signal to the elevator controller to initiate elevator recall and to a circuit breaker shunt trip for power shutdown.

2.09 WIRE AND CABLE

- A. Wire and cable for fire alarm systems shall be UL listed and labeled as complying with NFPA 70, Article 760.
- B. Signaling Line Circuits: Twisted, shielded pair, size as recommended by system manufacturer.
- C. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.

1. Low-Voltage Circuits: No. 16 AWG, minimum.
2. Line-Voltage Circuits: No. 12 AWG, minimum.

PART 3 - EXECUTION

3.01 EQUIPMENT INSTALLATION

A. Smoke or Heat Detector Spacing:

1. Smooth ceiling spacing shall not exceed **30 feet**.
2. Spacing of heat detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas, shall be determined according to Appendix A in NFPA 72.
3. Spacing of heat detectors shall be determined based on guidelines and recommendations in NFPA 72.

B. HVAC: Locate detectors not closer than **3 feet** from air-supply diffuser or return-air opening. Locate to avoid areas subject to condensation or humidification injection points.

C. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of the duct.

D. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location per ANSI 17.

E. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.

F. Audible Alarm-Indicating Devices: Install not less than **6 inches** below the ceiling. Install speakers and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.

G. Visible Alarm-Indicating Devices: Install adjacent to each alarm speaker or alarm horn and at least **6 inches** below the ceiling.

H. Device Location-Indicating Lights: Locate in public space near the device they monitor.

I. FACP: Surface mount with tops of cabinets not more than **72 inches** above the finished floor.

J. Annunciator: Install with top of panel not more than **72 inches** above the finished floor.

3.02 WIRING INSTALLATION

A. Install wiring according to the following:

1. NECA 1.
2. TIA/EIA 568-A.

B. Wiring Method: Install wiring in metal raceway according to Section 260533 "Raceways and Boxes."

1. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable.

- C. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- D. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
- E. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and a different color-code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.
- F. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum 1-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signals from other floors or zones.
- G. Wiring to Remote Alarm Transmitting Device: 1-inch conduit between the FACP and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.03 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals according to Section 260553 "Electrical Identification."
- B. Install instructions frame in a location visible from the FACP.
- C. Paint power-supply disconnect switch red and label "FIRE ALARM."

3.04 GROUNDING

- A. Ground the FACP and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to the FACP.

3.05 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. Perform the following field tests and inspections and prepare test reports:
 1. Before requesting final approval of the installation, submit a written statement using the form for Record of Completion shown in NFPA 72.
 2. Perform each electrical test and visual and mechanical inspection listed in NFPA 72. Certify compliance with test parameters. All tests shall be conducted under the direct supervision of a NICET technician certified under the Fire Alarm Systems program at Level III.

3. Visual Inspection: Conduct a visual inspection before any testing. Use as-built drawings and system documentation for the inspection. Identify improperly located, damaged, or nonfunctional equipment, and correct before beginning tests.
4. Testing: Follow procedure and record results complying with requirements in NFPA 72.
 - a. Detectors that are outside their marked sensitivity range shall be replaced.
5. Test and Inspection Records: Prepare according to NFPA 72, including demonstration of sequences of operation by using the matrix-style form in Appendix A in NFPA 70.

3.06 ADJUSTING

- A. Occupancy Adjustments: 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 two visits to Project outside normal occupancy hours for this purpose.
- B. Follow-Up Tests and Inspections: After date of Substantial Completion, test the fire alarm system complying with testing and visual inspection requirements in NFPA 72. Perform tests and inspections listed for three monthly, and one quarterly, periods.

3.07 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the fire alarm system, appliances, and devices. Refer to Division 1 Section "Closeout Procedures."

End of Section

SECTION 313116 - TERMITE CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Soil treatment with termiticide.

1.2 SUBMITTALS

A. Product Data: For each type of termite control product.

1. Include the EPA-Registered Label for termiticide products.

B. Qualification Data: For qualified Installer.

C. Product Certificates: For termite control products, from manufacturer.

D. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's records and include the following:

1. Date and time of application.
2. Moisture content of soil before application.
3. Termiticide brand name and manufacturer.
4. Quantity of undiluted termiticide used.
5. Dilutions, methods, volumes used, and rates of application.
6. Areas of application.
7. Water source for application.

E. Warranties: Sample of special warranties.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located, and who employs workers trained and approved by manufacturer to install manufacturer's products.

B. Regulatory Requirements: Formulate and apply termiticides and termiticide devices according to the EPA-Registered Label.

C. Preinstallation Conference: Conduct conference at Project site.

1.4 PROJECT CONDITIONS

- A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.
- B. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

1.5 WARRANTY

- A. Soil Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT

- A. Termiticide: Provide an EPA-Registered termiticide, complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.
 - 1. Products: Provide one of the following:
 - a. BASF Corporation, Agricultural Products; Termidor.
 - b. Bayer Environmental Science; Premise 75.
 - c. FMC Corporation, Agricultural Products Group; Dragnet FT or Prevail.
 - d. Syngenta; Prelude or Probuild TC.
 - 2. Service Life of Treatment: Soil treatment termiticide that is effective for not less than five years against infestation of subterranean termites.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil per termiticide label requirements, interfaces with earthwork, slab and foundation work, landscaping, utility installation, and other conditions affecting performance of termite control.
- B. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.
- B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.
 - 1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 APPLICATION, GENERAL

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.4 APPLYING SOIL TREATMENT

- A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.
 - 1. Slabs-on-Grade: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
 - 2. Foundations: Adjacent soil, including soil along the entire inside perimeter of foundation walls; along both sides of interior partition walls; around plumbing pipes and electric conduit penetrating the slab; around interior column footers, piers, and chimney bases; and along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
 - 3. Masonry: Treat voids.
 - 4. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.
- B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.
- C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.
- D. Post warning signs in areas of application.
- E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION 313116



GEOTECHNICAL EXPLORATION

KANNER HIGHWAY PUD – RESIDENTIAL & COMMERCIAL DEVELOPMENT
SOUTH KANNER HIGHWAY
STUART, FLORIDA

UES PROJECT No. 3330.2100102.0000

PREPARED FOR:

M&M at Stuart, LLC
1260 Stelton Road
Piscataway, New Jersey 08854

Attn: Chris Pompeo

PREPARED BY:

UES
607 NW Commodity Cove
Port St. Lucie, Florida 34986
(772) 924-3575

October 3, 2023

October 3, 2023

Chris Pompeo
M&M at Stuart, LLC
1260 Stelton Road
Piscataway, New Jersey 08854

Subject: Report of Geotechnical Exploration
Kanner Highway PUD – Residential & Commercial Development
South Kanner Highway, Stuart, FL
Parcel ID: 163841000000004603 / 163841000000004408
163841000000004426 / 403841001002000005
UES Project No. 3330.2100102.0000

Dear Chris Pompeo:

UES has completed the subsurface exploration and geotechnical engineering evaluation for the above referenced project in accordance with the geotechnical and engineering service agreement for this project. The scope of services was completed in general accordance with UES's Geotechnical Engineering Proposal No. 17-4445.01 REV #3 dated April 13, 2021, planned in conjunction with and authorized by you.

EXECUTIVE SUMMARY

The purpose of the subsurface exploration was to classify the nature of the subsurface soils and general geomorphic conditions at the site and evaluate their impact upon the proposed construction. This report contains the results of the subsurface exploration and UES's engineering interpretations of these with respect to the project characteristics described to UES, including providing recommendations for foundation design, pavement section and site preparation.

Per UES's prior telephone discussions and email correspondence with you, UES understands that you are planning to construct multiple 1-story commercial buildings and 4-story residential buildings with associated parking areas at the above-mentioned properties located off S Kanner Highway in Stuart, Florida. UES has been provided with a construction plan and specifications for Kanner CPUD – Phase 1A prepared by EDC Engineers, Surveyors and Environmental dated 04/19/2023 showing the layout of the proposed construction on the property.

UES conducted a preliminary exploration for the proposed development in the month of June and July 2023. However, UES performed additional borings within the footprint of the proposed residential and commercial buildings once the site was cleared of vegetation and raised to finished grades.

For the foundation recommendations presented in this report, UES assumed a maximum column and wall loading of **250 kips** and **8 kips per linear foot** for the 4-story residential buildings and maximum column and wall loading of **100 kips** and **5 kips per linear foot** for 1-story commercial buildings, respectively.

The recommendations provided herein are based upon the above considerations. If the stated conditions are incorrect or if the project description is revised, please inform UES so that recommendations with respect to any modifications may be reviewed.

Nineteen (19) Standard Penetration Test (SPT) borings (R-1 through R-10, CR-1 through CR-4 and L-1 through L-5) advanced to a depth of approximately 20 to 30 feet below ground surface (BGS) were performed within the proposed commercial, residential and lake areas, respectively.

Twelve (12) hand auger boring with Hand Cone Penetrometer (HCP) testing (P-1 through P-12) advanced to a depth of 6 feet BGS were performed within the planned pavement areas. Additionally, two (2) exfiltration testing (EX-1 and EX-2) advanced to an approximate depth of 6 feet BGS were performed within the proposed parking/pavement areas associated with the commercial buildings.

Furthermore, three (3) hand auger borings with HCP testing (ST-1 through ST-3) advanced to a depth of 6 feet BGS along with three (3) shelly tubes to test for horizontal and vertical permeability rates were performed within the dry retention areas.

The subsurface soil conditions encountered at the boring locations generally consisted of very loose to dense fine sand (SP), fine sand with little silt (SP-SM), fine sand with some silt (SM) and fine sand with some clay (SC) to the termination depths of the borings.

Considering the results of the field exploration program, and the subsurface soil conditions revealed by the borings, the proposed structures will be generally favorable for support on shallow foundations. A maximum allowable soil bearing pressure of **2,500 psf** may be used for foundation design.

UES appreciates the opportunity to be of service during this phase of the project and looks forward to a continued association. Please do not hesitate to contact UES if you have any questions or comments, or if UES may further assist you as your plans proceed.



Respectfully Submitted,
UES
Florida Registry No. 4930

This item has been digitally signed and sealed by Estela G. León Aguilar, M.S., P.E. on the date adjacent to the seal. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

Estela G. León Aguilar, M.S., P.E.
Senior Geotechnical Engineer
Florida Registration No. 83307

Dhanuhasini Subramaniam, E.I.
Project Engineer

Distribution: Chris Pompeo - M&M at Stuart, LLC

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1.0 INTRODUCTION

1.1 Scope of Services

The objective of the geotechnical services was to collect subsurface data for the subject project, summarize the test results, and discuss any apparent site conditions that may have geotechnical significance for the proposed construction. The following scope of services is provided within this report:

1. Prepare boring logs depicting the subsurface soil conditions encountered during the field exploration.
2. Review the soil samples obtained during the field exploration for classification and additional testing if necessary.
3. Evaluate the existing soil conditions found during the exploration with respect to foundation support for the proposed construction.
4. Provide recommendations with respect to foundation support of the proposed buildings, including foundation type, maximum allowable soil bearing capacity, and bearing elevations.
5. Provide site preparation criteria for the proposed construction.

1.2 Project Description

Per UES's prior telephone discussions and email correspondence with you, UES understands that you are planning to construct multiple 1-story commercial buildings and 4-story residential buildings with associated parking areas at the above-mentioned properties located off S Kanner Highway in Stuart, Florida. UES has been provided with a construction plan and specifications for Kanner CPUD – Phase 1A prepared by EDC Engineers, Surveyors and Environmental dated 04/19/2023 showing the layout of the proposed construction on the property.

UES conducted a preliminary exploration for the proposed development in the month of June and July 2023. However, UES performed additional borings within the footprint of the proposed residential and commercial buildings once the site was cleared of vegetation and raised to finished grades.

For the foundation recommendations presented in this report, UES assumed a maximum column and wall loading of **250 kips** and **8 kips per linear foot** for 4-story residential buildings and maximum column and wall loading of **60 kips** and **5 kips per linear foot** for 1-story commercial buildings, respectively.

The recommendations provided herein are based upon the above considerations. If the stated conditions are incorrect or if the project description is revised, please inform UES so that recommendations with respect to any modifications may be reviewed.



2.0 OBSERVATIONS

2.1 Site Description and Historical Data

As illustrated on the Site Vicinity Map in **Appendix A**, the site is located off S Kanner Highway in Stuart, Florida. The property is bordered by Martin County High School to the north, residential properties to the south, SE Willoughby Boulevard to the east and S Kanner Highway to the west. At the time of the field exploration, the site had undergone clearing and grubbing activities and was relatively flat and the proposed testing locations were open.

UES reviewed historic aerials dated from 1958 to 2019. The historic aerial from 1958 to 1968 reveals that the site was undeveloped with slight vegetation. Also, the aerials from 1984 to 2007 indicate heavy vegetation at the site. Furthermore, the aerials from 2010 to 2019 revealed that there were several buildings to the east and northeast side of the property. Several ponds were encountered at the site. Please refer to **Appendix G** for further information.

2.2 Field Exploration

For the preliminary exploration, UES performed:

- Ten (10) Standard Penetration Test (SPT) borings (R-1 through R-10) advanced to a depth of approximately 25 feet below ground surface (BGS) within the proposed 4-story residential buildings.
- Four (4) Standard Penetration Test (SPT) borings (CR-1 through CR-4) advanced to a depth of approximately 20 feet below ground surface (BGS) within the proposed 1-story commercial buildings.
- Five (5) Standard Penetration Test (SPT) borings (L-1 through L-5) advanced to a depth of approximately 30 feet below ground surface (BGS) within the lake areas.
- Twelve (12) hand auger boring with Hand Cone Penetrometer (HCP) testing (P-1 through P-12) advanced to a depth of 6 feet BGS were performed within the planned pavement areas.
- Two (2) exfiltration testing (EX-1 and EX-2) advanced to an approximate depth of 6 feet BGS were performed within the proposed parking/pavement areas associated with the commercial buildings.
- Three (3) hand auger borings with HCP testing (ST-1 through ST-3) advanced to a depth of 6 feet BGS along with three (3) Shelby tubes to test for horizontal and vertical permeability rates were performed within the dry retention areas.



Upon raising the existing grade on-site to finished grades, UES performed:

- Eight (8) Standard Penetration Test (SPT) borings (R-11 through R-18) advanced to a depth of approximately 25 feet BGS within the proposed 4-story residential buildings.
- Four (4) Standard Penetration Test (SPT) borings (CR-5 through CR-8) advanced to a depth of approximately 20 feet below ground surface (BGS) within the proposed 1-story commercial buildings.

The boring depths were established based upon UES's knowledge of vicinity soils and confined to the zone of soil likely to be influenced by the planned construction. The locations of the borings are illustrated on the Test Location Plan in **Appendix B**.

The Standard Penetration Tests (SPT) were performed in general accordance with ASTM D 1586, "Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils." The SPT test procedure consists of driving a 1.4-inch I.D. split-barrel sampler into the soil profile using a 140-pound hammer falling 30 inches. The number of blows per foot, for the second and third 6-inch increment, is referred to as the N-value. The N-value has been empirically correlated with various soil properties and provides an indication of soil strength.

The auger borings were performed in general accordance with ASTM D 1452, "Standard Practice for Soil Exploration and Sampling by Auger Borings." Hand Cone Penetrometer (HCP) tests were conducted at approximate one-foot depth intervals in the auger borings. The HCP test, in conjunction with information about the soil type, is empirically correlated to the relative density of subsurface soils. Please refer to **Appendix C** - Notes Related to Borings for further clarification of UES's field exploration.

Site specific survey staking of the borings was not provided for this field exploration. The indicated depth and location of each boring were approximated based upon existing grade and estimated distances and relationships to the existing landmark at the site.

2.3 Laboratory Testing

Soil samples recovered from the field exploration were returned to UES's laboratory where they were visually classified by a geotechnical engineer in general accordance with the Unified Soil Classification System (ASTM D 2488). Selected samples were tested for moisture content (ASTM D 2216), fines content (ASTM D 1140) and organic content (ASTM D 2974). The laboratory test results are summarized in Table 2.3.1 below and are also contained on the boring logs.



Table 2.3.1 - Laboratory Test Results					
Boring No.	Strata Depth (feet)	Sample Description	Moisture Content (%)	Fines Content (%)	Organic Content (%)
L-4	18.5 – 21.0	Brown fine sand, little silt (SP-SM)	35.7	8.0	-
R-9	4.5 – 6.5	Dark brown organically stained fine sand, little silt, trace fine roots (SP-SM)	16.8	8.8	4.1
R-10	5.0 – 7.0	Brown fine sand, some silt, trace fine roots (SM)	16.4	16.4	-
L-5	9.0 – 11.0	Dark brown fine sand, some silt (SM)	18.5	15.1	-
R-11	3.0 – 5.0	Dark brown fine sand, little silt (SP-SM)	7.7	5.1	-
R-12	0.0 – 3.0	Dark brown fine sand, little silt (SP-SM)	10.7	6.6	-
R-13	5.0 – 6.5	Gray fine sand, some clay, trace root fibers (SC)	12.3	17.6	1.5
R-18	5.5 – 7.0	Dark brown fine sand, little silt, trace organics (SP-SM)	16.5	8.1	5.0
CR-7	6.5 – 8.0	Gray fine sand, some clay (SC)	17.2	13.4	-

Laboratory falling head permeability tests were also performed upon the Shelby tube soil samples obtained during the field exploration. This testing was performed to obtain horizontal (k_h) and vertical (k_v) permeability values for the in-situ soils within the stormwater management areas. The permeability test results are summarized in Table 2.3.2 below.

Table 2.3.2 - Falling Head Permeability Test Results				
Test Location	Sample Depth (feet)	Sample Description	Coefficient of Permeability, k (ft/day)	
			K_h	K_v
ST-1	2 – 2.5	Light gray fine sand (SP)	10	23
ST-2	2 – 2.5	Light gray fine sand (SP)	26	30
ST-3	2 – 2.5	Dark gray - gray fine sand, trace roots (SP)	7	13



The samples will be retained in UES's laboratory for 30 days and then discarded unless UES is notified otherwise in writing. The recovered samples were not evaluated, either visually or analytically, for chemical composition or environmental hazards. UES will be pleased to perform these services for an additional fee, if required.

2.4 Geomorphic Conditions

The geology of the site as mapped on the USDA Soil Survey website consists of *Waveland and Lawnwood fine sands, depressional (5)*, *Waveland and Immokalee fine sands (4)*, *Jonathan sand, 0 to 5 percent slopes (41)*, and *Salerno sand (35)*. **These are sandy soils.** Note that the Soil Survey generally extends to a maximum depth of 80 inches below ground surface and is not indicative of deeper soil conditions.

Boring logs resulting from the field exploration are presented in **Appendix D** - Log of Boring Records. The logs contain the soil descriptions, hand cone penetrometer (HCP) and the standard penetration test (SPT) N-values logged during the drilling and sampling activities. Note that the soil boring data reflects information from the specific test locations only and the soil conditions may vary between the strata interfaces indicated on the logs. The soil classifications and descriptions shown on the logs are generally based upon visual characterizations of the recovered samples using the Unified Soil Classification System. See **Appendix F** - Discussion of Soil Groups, for a detailed description of various soil groups.

The subsurface soil conditions encountered at the boring locations generally consisted of very loose to dense fine sand (SP), fine sand with little silt (SP-SM), fine sand with some silt (SM), and fine sand with some clay (SC) to the termination depths of the borings. For a more precise description of the conditions encountered within the soil test borings, refer to the "Log of Boring Records" included in Appendix D.

2.5 Hydrogeological Conditions

On the date of UES's field exploration (June, July, and September 2023), groundwater was encountered in the borings at a depth of approximately 2.0 to 6.0 feet below existing ground surface (BEGS). Because of the substantial variations encountered, UES estimates that apparent water tables may form at different boring locations across the site. This condition might be temporary as it depends on time and adjustments in the surrounding soil. The groundwater table typically fluctuates seasonally depending upon local rainfall and other site specific and/or local influences. Brief ponding of stormwater may occur across the site after heavy or extended rainfall events.

No additional evaluation was included in UES's scope of work in relation to the wet seasonal high groundwater table or any existing well fields in the vicinity. Well fields may influence water table levels and cause significant fluctuations. If a more comprehensive water table analysis is necessary, please contact UES for additional guidance.



2.6 Exfiltration Testing

The exfiltration test was performed in accordance with the South Florida Water Management District method for open-hole constant head field testing to an approximate depth of 6 feet below existing grades. The results are presented in the Exfiltration Test Report in **Appendix E** - Hydraulic Conductivity Tests. The hydraulic conductivity (K) value determined at the test site is presented in the table below.

Test Location	K (cfs/ft ² -ft)
EX-1	1.30 X 10 ⁻⁰⁴
EX-2	1.95 X 10 ⁻⁰⁴

3.0 ENGINEERING EVALUATION AND RECOMMENDATIONS

3.1 General

Based on the scope of the proposed project and once ground improvement techniques discussed herein have been completed, it is UES's opinion that the soils are generally suitable for support of the proposed structures using a shallow foundation system.

Placement and compaction of fill should be closely monitored by an authorized representative of UES. A representative number of in-place field density tests and/or re-test borings should be performed in the compacted soils to confirm the required degree of compaction has been achieved.

The allowable amount of settlement that a structure may tolerate is dependent on several factors including uniformity of settlement, time rate of settlement, structural dimensions, and properties of the structural materials. Generally, total, or uniform settlement does not damage a structure but may affect drainage and utility connections. These can generally tolerate movements of several inches for building construction. In contrast, differential settlement affects a structure's frame and is limited by structural flexibility. Preliminarily, shallow foundations appear to be suitable for the proposed project and can be used to support the proposed structure at this site, provided that the existing ground surfaces and any fill soils are properly prepared as discussed herein. Shallow foundations can consist of conventional shallow continuous strip footings and isolated spread footings, or a monolithic turned down footing and slab type foundation.

3.2 Site Preparation

The following steps shall be incorporated in the construction plans in order to prepare the subgrade soils for construction of spread footings and/or isolated footings to support the proposed structures:



1. Initial site preparation for the proposed structures should consist of removing the existing surface cover, structures, buried organics, and landscape areas. Disposal of these materials shall be accomplished in accordance with local and municipal guidelines.
2. No information has been provided about previous or existing foundations at the site. Where existing foundations are encountered, they should be completely removed and replaced with compacted fill if they interfere with new foundations. Disposal of these materials shall be accomplished in accordance with local and municipal guidelines.
3. Existing underground drainage/utility pipes (if any) to be relocated shall be abandoned by either complete removal and subsequent soil backfilling in accordance with the recommendation provided herein or left in-place and filled with "flowable fill".
4. Following the site stripping, areas of surficial sand should be compacted prior to the placement of any fill. UES recommends a steel drum vibratory roller with a minimum static weight of 20,000 lbs. and minimum vibratory impact energy of 50,000 lbs. The roller should be operated at 2 mph making at least 10 perpendicular overlapping passes. Densification should continue until no further settlement can be visually discerned at the excavated surface. No section of the subgrade should receive less than 4 passes of the roller or until at least 98% maximum density (ASTM D 1557) is achieved for a depth of at least **1 foot below** the excavated surface. Upon completion of the proof rolling, backfill shall be placed in maximum 12-inch loose lifts and compacted to a minimum density of **98 percent** of the Modified Proctor maximum dry density (ASTM D-1557).
5. The bottom of footing excavations shall be compacted with a steel drum vibratory roller with a minimum static weight of 20,000 lbs. and minimum vibratory impact energy of 36,000 lbs.; (Dynapac CA-250D or equivalent) or equivalent equipment. The roller should be operated at 2 mph. Additional passes may be necessary if acceptable compaction is not achieved. Density tests shall be completed at footing subgrade to confirm that the soils have achieved a minimum degree of compaction of 95 percent of modified proctor maximum density (ASTM D-1557). The bottom of all footings shall be examined by the engineer or his representative to determine if the soil is free of all organic and/or deleterious materials, and if the required compaction and soil pressures are achieved or if additional compaction is required.
6. Fill material placement (if needed) should be inorganic (classified as SP/SW) containing not more than 5 percent (by weight) fibrous organic materials. Fill materials with silt-size soil fines in excess of 10% should not be used, this includes cyclone sand material. Place fill in maximum 12-inch lifts and compact each lift to a minimum density of 95 percent of the Modified Proctor maximum dry density (ASTM D-1557) with a vibratory roller. Perform compliance tests within



the fill at a frequency of not less than one test per 2,500 square feet per lift in the building areas, or a minimum of 2 test locations per lift, whichever is greater.

7. The structural fill or backfill to be placed below the water table and to a height of one foot above it should consist of a combination of FDOT 57 Stone and structural fill material mixed in an approximate 50% proportion by volume. Density testing will not be required within this layer; however, the subgrade preparation work should be observed by a representative from GFA's office to confirm that the material is in a stable and unyielding condition.
8. It is likely that proof-rolling and any subsequent backfill compaction with the aforementioned equipment may induce ground vibrations that can affect the existing adjoining structures. A representative from UES's office can monitor the vibration disturbance using seismograph equipment capable of recording ground velocities that can be used to determine if construction activity at the site is exceeding tolerable vibration levels on adjacent structures as established by the project structural engineer.
9. Depending on the depth of the footings, groundwater control may be required at this site for either excavation dewatering or removal of temporarily perched water from a rain event. Such water can be controlled by pumping from sumps located in ditches or pits. Groundwater should be maintained at least one foot below the bottom of any excavation made during construction operations, or at least two feet below the surface of any compaction operations.
10. The contractor shall consider the final contours and grades as established by the plan when executing his backfilling and compaction operations.
11. If site preparation work is performed during the rainy season (May through October), special care should be taken to maintain positive drainage from the building pad and paved areas to drains or ditches around the site. Unexpected wet periods can also occur in Florida during the "dry" season. Such events can raise water tables to levels above seasonal highs without the associated high temperatures to evaporate ponded water. Therefore, the contractor should practice wet weather means and methods for earthwork during the "dry" season as well. Groundwater and surface water control, use of granular fill material and aeration are typical means to accomplish wet weather grading.

Using vibratory compaction equipment can disturb adjacent structures. If vibration related disturbance to nearby structures may be of concern, vibration levels should be monitored during compaction operations. A representative from this office can monitor the vibration disturbance of adjacent structures; and a proposal for these services can be provided upon your request.



3.3 Shallow Foundation

Based on the soil conditions encountered and with the site prepared as recommended above, foundations supported on well compacted fill may be designed for a net allowable bearing pressure of **2,500 pounds per square foot (psf)**. To assure a satisfactory factor of safety against bearing capacity failure, the foundation bottoms should be placed a minimum of 12 inches below the lowest adjacent grade and monolithic thickened edge slabs at least 8 inches. Any continuous footings should be at least 16 inches wide and isolated foundations should be at least 30 inches wide. Any footings that tie into existing footings should be doweled together.

Settlement calculations were made using the prepared site conditions and loadings presented in the foundation recommendations above. With the site prepared and the foundations designed and constructed as recommended, UES anticipates settlements of one (1) inch or less and differential settlements of one-half ($\frac{1}{2}$) inch or less between adjacent columns or a horizontal distance of 20 feet. Because of the granular nature of the subsurface soils, the majority of the settlements should occur during construction; post-construction settlement should be minimal.

3.4 Ground Floor Slabs

The ground floor slabs may be constructed upon either existing grade or granular fill following completion of the foundation site preparation and fill placement procedures outlined in this report. UES recommends that a modulus of subgrade reaction (k) of 150 pounds per cubic inch (pci) be considered during design. The floor slabs should be structurally separated from walls and columns to allow for differential vertical movement unless monolithic slab foundations are designed.

Excessive moisture vapor transmission through foundation slabs can result in damage to floor coverings as well as cause other deleterious effects. An appropriate moisture vapor barrier should be placed beneath the slabs to reduce moisture vapor from entering the structures through the slabs. The barriers should be installed in general accordance with applicable ASTM procedures including sealing around pipe penetrations and at the foundation edges.

3.5 Pond/Lake Reclamation

There is at least one (1) pond within the site that possibly would be required to be reclaimed. Reclamation for development purposes must proceed by removal and excavation of vegetation and all soft and loose sediments from the bottom and side slopes. The Geotechnical Engineer or his/her representative should verify organic material, sediments, and or other unsuitable subgrade material are excavated and removed, and the underlying material is native soil prior to backfilling. Backfill material should be placed and compacted in accordance with the "Site Preparation Recommendations" section of this report. As an added precaution, and to reduce the risk of future settlement issues, the subsurface soil conditions of the backfilled pond



should be checked by advancing Standard Penetration Test (SPT) borings to confirm relative density of the backfilled soils.

3.6 Borrow Suitability (Retention Lakes)

Borings L-1 through L-5 were performed at the lake areas to evaluate the suitability of the soils for use as fill during site development. The soils encountered in these borings generally consisted of fine sand (SP), and fine sand with little silt (SP-SM), to the termination depths.

Soils classified as SP (fine sand and fine sand with trace shell fragments) contain less than 5 percent fines (percent of dry weight passing the U.S. No 200 sieve). These soils dry rapidly and compact easily, even under wet conditions. They perform well for building foundations or roadway subgrade fill and are usually adequate for use as drainage material with a relatively high permeability.

Soils classified as SP-SM (fine sand with little silt) contain between 5 and 12 percent fines. This soil often requires some drying time prior to placement and compaction but is typically suitable for use as fill for buildings and roadways. They do not drain as rapidly and have a relatively lower permeability for use as drainage material.

Soils classified as SM (silty fine sand) and SC (clayey fine sand) have fines contents exceeding 12 percent. These soils are very difficult to compact when wet, do not drain well, and have low permeability for use as drainage material. Although these soil types are suitable for use as fill, they have an affinity to retain moisture and prolonged drying time is necessary, commonly resulting in moisture-related construction delays. Note that these soils are often used for non-structural applications, such as lawns or landscape areas.

If it is desired to use SM or SC soils as fill for the project, the soils should be spread (not stockpiled) either upon active fill areas or within designated staging areas, repeatedly disced, and then reworked frequently to promote drying. Only after the moisture content has been reduced sufficiently should they be placed and compacted as fill. These soils can also be blended with low fines content (SP) soils to lower the overall fines content of the mixed soils and improve their ability to be used as fill.

During excavation of soils from the pond and any other designated borrow areas, care should be exercised by the contractor to separate suitable and any unsuitable (organic/silty/clayey) soils that may be encountered. This process will facilitate the overall fill placement and compaction process. In addition, it should be anticipated that soil excavated below the groundwater table will likely require additional drying time before it can be placed as controlled, compacted fill.



4.0 PAVEMENT AREA DESIGN AND CONSTRUCTION CONSIDERATIONS

4.1 Pavement Site Preparation

UES's recommendations for preparation of the site for pavement construction are noted below. This approach to improving and maintaining site soil has been found to be successful with similar soil conditions.

1. Initial site preparation should consist of performing dewatering operations (if necessary) prior to any earthwork.
2. The proposed construction limits should be cleared, stripped, and grubbed of all surface vegetation, topsoil, and associated root systems to depths of their vertical reaches. This should be performed within and to 5 feet beyond the limits of the pavement areas.
3. Prior to initiating fill operations, the existing ground surface should be compacted (proof rolled) using a steel drum vibratory roller having sufficient static weight and vibratory impact energy to achieve the required compaction. After completing the proof rolling, density tests should be performed at a frequency of one test per 5,000 square feet, or at a minimum of two test locations, whichever is greater, to confirm a minimum compaction compliance of 98 percent of modified Proctor maximum dry density (AASHTO T-180).
4. Fill material should be inorganic (classified as SP/GW) containing not more than 5 percent (by weight) fibrous organic materials. **Fill material having silt/clay-size fines contents greater than 5 percent should not be used, including cyclone sand material.** The fill should be placed in maximum 12-inch-thick lifts. Each lift should be compacted to a minimum density of 98 percent of modified Proctor maximum dry density (AASHTO T-180).
5. Compliance density tests should be performed within the fill at a frequency of not less than one test per 5,000 square feet per lift, or at a minimum of two test locations, whichever is greater.
6. Representative samples of both on-site and import materials proposed for use as fill should be obtained and tested to determine compliance with the project specifications. The testing should include moisture-density relations (AASHTO T-180) and particle size analysis.
7. The contractor should consider the contours contained on the final grading, paving, and drainage plans when executing backfilling and compaction operations.



4.2 Pavement Design Sections

Flexible pavement sections in the geographic area typically consist of an asphaltic wearing course, a base course, and a stabilized subgrade layer. Rigid pavements are constructed either directly upon prepared soil subgrades or upon a base course and stabilized subgrade for heavier loads. Based on UES's prior experience and the assumed traffic loading criteria, recommended pavement section thicknesses are provided in Table 4.2.1 below.

Table 4.2.1 Design Pavement Sections					
Type of Pavement	Layer	Material Description	Layer Thickness		
			Light Duty	Heavy Duty*	FDOT ROW
Flexible	(A)	FDOT Type S (non FDOT) or SP (FDOT)	1.5	2.5	3
	(B)	Crushed Base with minimum LBR of 100, compacted to 98% of the modified Proctor maximum dry density	6	8	15
	(SG)	Stabilized sub-grade fill, compacted to 98% of the modified Proctor maximum dry density	12	12	12
	STRUCTURAL NUMBER (SN)		2.7	3.5	4.98
Rigid	(C)	Florida DOT Portland Cement Concrete	NA	8**	NA
	(B)	Crushed Limerock with minimum LBR OF 100, compacted to 98% of the modified Proctor maximum dry density	NA		NA
	(CG)	Compacted sub-grade fill, compacted to 98% of the modified Proctor maximum dry density	NA	12	NA
A = Asphaltic Concrete (Layer Coefficient = 0.44 per inch) B = Base Course (Layer Coefficient = 0.18 per inch) (note: Minimum LBR for recycled concrete is 120 for an equivalent layer coefficient of 0.18 per inch) SG = Stabilized Subgrade (Layer Coefficient = 0.08 per inch) CG = Compacted Subgrade (Layer Coefficient = 0.01 per inch) C = Concrete (based on 4,000 psi compressive strength)					

* Based on Table 3.4 from ACI 330, Category "D" – Tractor Trailer Units with one or more trailers

** Can be reduced by 1.0 inch if dowels at transverse joints are used.

It should be noted that these are the minimum requirements, and the final pavement thickness design should be provided by the project civil engineer based on anticipated traffic loadings. Asphalt pavements should be constructed in accordance with the latest edition of the Florida Department of Transportation Flexible Pavement Design Manual.

4.3 Stabilized Subgrade

The stabilized subgrade material should have a minimum Limerock Bearing Ratio (LBR) value of 40. UES recommends that subgrade material be compacted to at least 98 percent of modified Proctor maximum dry density (AASHTO T-180). Compliance tests should be performed upon the stabilized subgrade for full depth at a frequency of one test per 5,000 square feet, or at a minimum of two test locations, whichever is greater.



4.4 Base Course

The base course is the portion of the pavement section between the surface course and stabilized subgrade. In areas where separation of at least 1.5 feet between the estimated wet seasonal high groundwater table and the bottom of the base material occurs, UES recommends the base course be limerock or cemented coquina having a minimum Limerock Bearing Ratio (LBR) value of 100. The base material should be obtained from an approved source. The base material should be placed in maximum 6-inch-thick lifts and compacted to at least 98 percent of modified Proctor maximum dry density (AASHTO T-180).

If the separation between the estimated wet seasonal high groundwater table and the bottom of the base material is less than 1.5 feet, UES recommends that asphaltic concrete base (FDOT SP-12.5) be used in lieu of limerock or cemented coquina. The subgrade should be mechanically stabilized (compacted) to a minimum of 98 percent of modified Proctor maximum dry density (AASHTO T-180). Compliance tests should be performed on the base course at a frequency of one test per 5,000 square feet, or a minimum of two test locations, whichever is greater.

4.5 Flexible (Asphalt) Pavement

Asphalt pavement should consist of either FDOT SP-9.5 or SP-12.5 asphaltic concrete. The mixes should be a current FDOT approved design for the materials used for the project. Samples of the materials delivered to the project should be tested to verify that the aggregate gradation and asphalt content satisfies the mix design specifications.

The asphalt should be compacted to meet the requirements of the latest edition of the FDOT *Standard Specifications for Road and Bridge Construction*. Compliance tests should be performed by obtaining cores to evaluate material thickness and density at a frequency of one test per 10,000 square feet, or a minimum of two test locations, whichever is greater.

4.6 Rigid (Concrete) Pavement

Rigid pavements should be constructed using concrete having a minimum 28-day compressive strength of 4,000 psi. Fill required to raise grades in pavement areas should be compacted to at least 98 percent of modified Proctor maximum dry density (AASHTO T-180).

The pavement slabs should be reinforced to make them as rigid as practical. Proper joints should be provided at the junctions of slabs so that a small amount of independent movement can be done without causing structural damage. Construction and control joints should be accordance with current American Concrete Institute (ACI) and industry practices. The ACI 330R guidelines recommend *contraction joints* based on the thickness of the slab. A contraction joint predetermines the location of cracks caused by restrained shrinkage of the concrete and be the effects of loads and warping and curling.



Table 3.13—Spacing between contraction joints

Pavement thickness, in. (mm)	Maximum spacing, ft (m)
3-1/2 (90)	8-1/2 (2.5)
4, 4-1/2 (100, 110)	10 (3)
5, 5-1/2 (125, 140)	12-1/2 (4)
6 or greater (150 or greater)	15 (4.5)

The depth of the *contraction joint* should be at least $\frac{1}{4}$ of the slab thickness. The width of the cut depends on whether the joint will be sealed. A narrow joint, generally $\frac{1}{10}$ to $\frac{1}{8}$ in. wide, is common for unsealed joints. Cuts at least $\frac{1}{4}$ in. wide are required for sealed joints. Joint sealant manufacturers' recommendations should be followed for the depth and width of joints that are to be sealed. Sawing operations should be done within 4 to 12 hours after the localized finishing of an area.

Expansion (isolation) joints are recommended at pavement areas that will move independently of each other. Such areas include where aisles intersect or near fixed structures such as inlets, light poles, manholes and buildings. These full depth joints should contain a compressible filler to prevent the adjacent slabs from bonding to each other.

UES recommends distributed steel reinforcement to control the opening of intermediate cracks between the joints. The sole function of the distributed steel is to hold together the fracture faces of cracks form. The size of the steel (welded wire fabric) should be sized in accordance with section 3.8.1 of ACI 330R.

Lastly, actual pavement section thickness should be provided by the Design Civil Engineer based on traffic loads, volume, and the owner's design life requirements. The above section represents the minimum thickness representative of typical local construction procedures and, as such, periodic maintenance should be anticipated. All pavement materials and construction procedures should conform to the FDOT, American Concrete Institute (ACI), or appropriate city/county requirements.

4.7 Effects of Water

Premature pavement section deterioration can occur due to intrusion of the wet season high groundwater table and/or improper surface water runoff management. UES recommends that the pavement areas be constructed to have a minimum separation of 1.5 feet between the wet season high groundwater table and the bottom of base course, regardless of the type of base material. In addition, we recommend that full-depth curb sections be designed and constructed. Using either extruded curb sections, which lie directly on top of the final surface course, or eliminating the curbing entirely, may allow runoff and/or irrigation water to migrate between the base and surface course. This condition can result in the separation of the surface course from the base course, causing a rippling effect, which results in premature deterioration of the pavement.



4.8 Construction Traffic

Incomplete pavement sections or pavement areas designed for light duty traffic will not perform satisfactorily under typical construction traffic loading. UES recommends that all construction traffic (i.e., construction equipment, vehicles, etc.) either be re-routed away from these areas or the pavement sections be designed to support construction phase loading conditions.

5.0 EXCAVATION CONDITIONS

In Federal Register, Volume 54, No. 209 (October 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, part 1926, Subpart P". This document was issued to better insure the safety of workmen entering trenches or excavations. It is mandated by this federal regulation that all excavations, whether they be utility trenches, basement excavations or footing excavations, be constructed in accordance with the OSHA guidelines. It is UES's understanding that these regulations are being strictly enforced and if they are not closely followed, the owner and the contractor could be liable for substantial penalties.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The contractor's responsible person, as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations. UES is providing this information solely as a service to UES's client.

UES is not assuming responsibility for construction site safety or the contractor's activities; such responsibility is not being implied and should not be inferred.

6.0 REPORT LIMITATIONS

This consulting report has been prepared for the exclusive use of M&M at Stuart, Inc., and other members of the design team for the proposed development located at S Kanner Highway in Stuart, Florida. This report has been prepared in accordance with generally accepted local geotechnical engineering practices; no other warranty, either express or implied, is made.

The geotechnical evaluation submitted in this report is based in part upon limited data collected during a field exploration. This report does not reflect any variations which may occur between borings. While the borings represent the subsurface conditions at their respective locations and for their vertical reaches, local variations characteristic of the subsurface soils within the region are anticipated and may be encountered. The delineation between soil types shown on the boring logs is approximate and the



descriptions represent the interpretation of the subsurface conditions at the designated boring locations on the specific dates performed.

UES should be provided with the opportunity to review the final foundation plans and specifications to determine if UES's recommendations have been properly interpreted, communicated, and implemented. If UES is not afforded the opportunity to participate in construction related aspects of foundation installation as recommended in this report or any report addendum, UES cannot accept responsibility for the interpretation of UES's recommendations made in this report or in a report addendum for foundation performance.

7.0 BASIS FOR RECOMMENDATIONS

The recommendations presented in this report are based on the data obtained from the borings performed at the locations indicated on the Test Location Plan in Appendix B. This report does not reflect variations which may occur between borings. While the borings are representative of the subsurface conditions at their respective locations and for their vertical reaches, local variations characteristic of the subsurface soils of the region are anticipated and may be encountered. The delineation between soil types shown on the boring logs is approximate and the descriptions represent UES's interpretation of the subsurface conditions at the designated boring locations on the specific date drilled.

Any third-party reliance of UES's geotechnical report or parts thereof is strictly prohibited without the express written consent of UES. The applicable SPT methodology (ASTM D 1586) and auger boring methodology (ASTM D 1452) used in performing the borings, and for determining penetration resistance and soil relative density, is specific to the sampling tools utilized and does not reflect the ease or difficulty to advance other tools or materials.



Appendix A - Vicinity Map

Site Vicinity Map

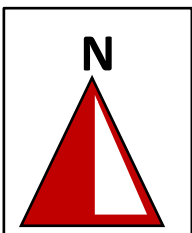
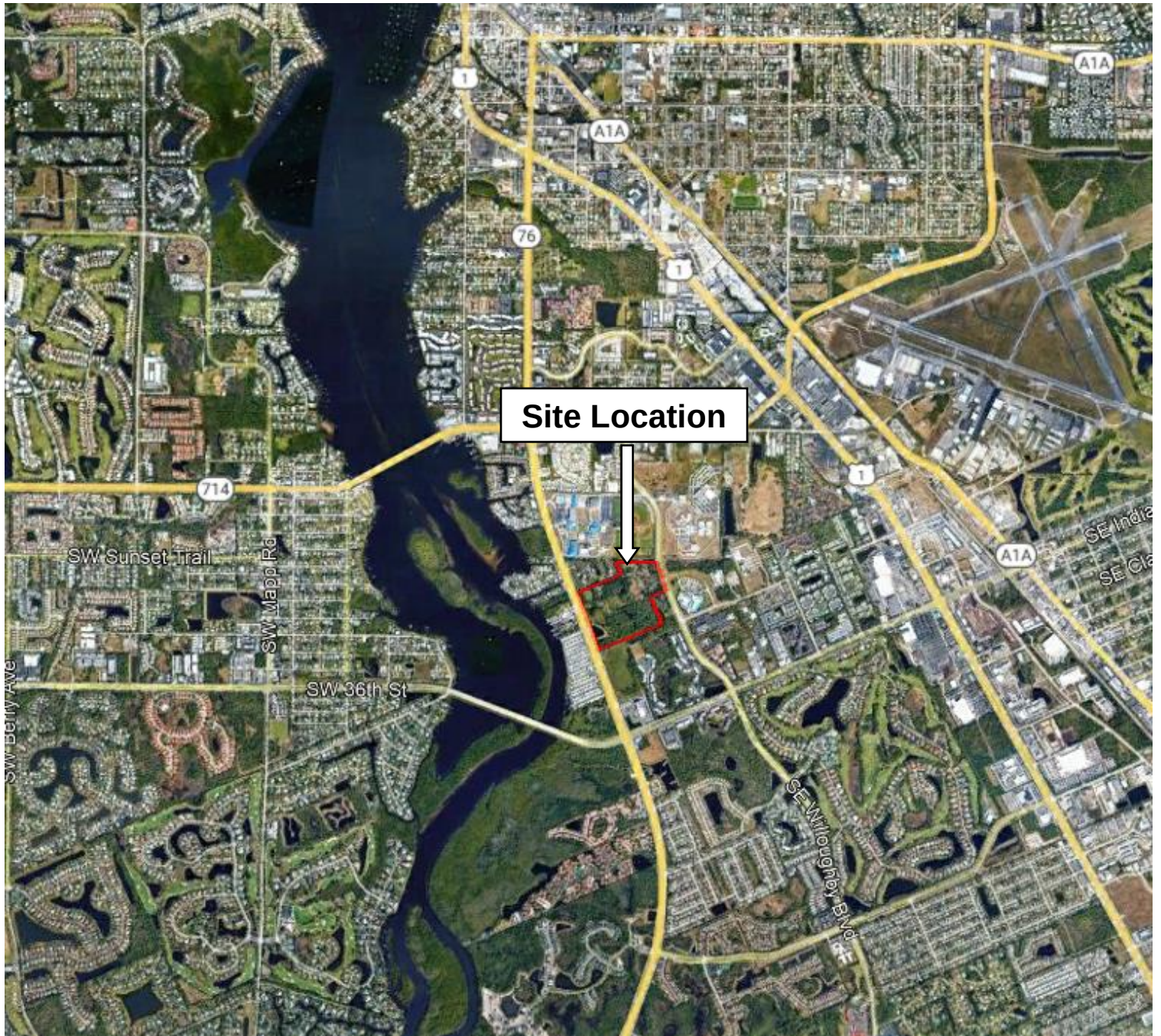
Costco Kanner Highway
S Kanner Highway, Stuart, Florida

Project No. 3330.2100102.0000

Drafted by: JR

Reviewed By: AA

Date: 9/14/2023



Appendix B - Test Location Plan

Test Location Plan

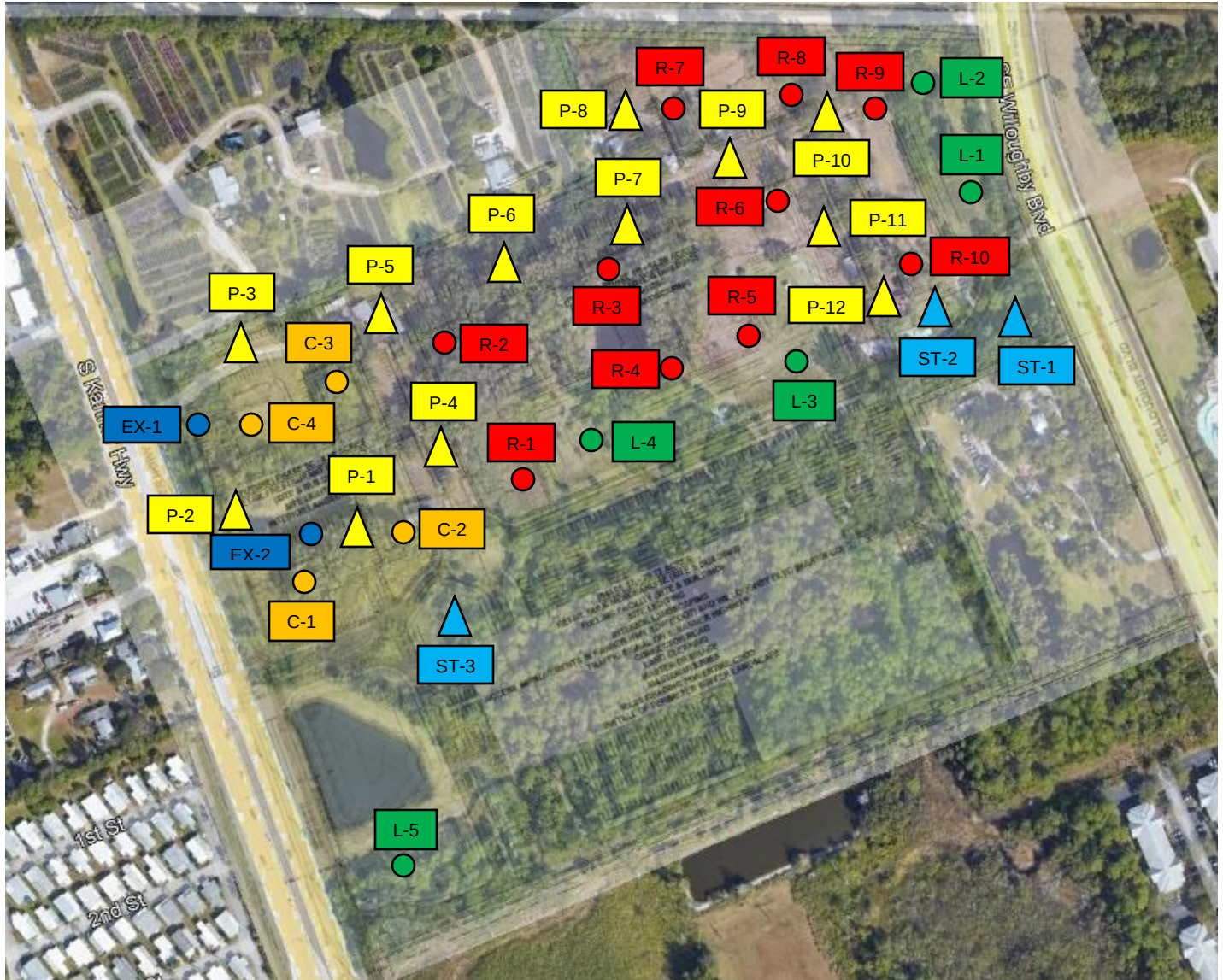
Costco Kanner Highway
S Kanner Highway, Stuart, Florida

Project No. 3330.2100102.0000

Drafted by: JR

Reviewed By: AA

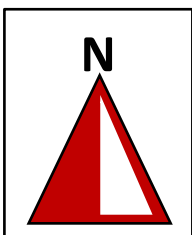
Date: 9/14/2023



Legend

-  Approximate 30' Standard Penetration Test Boring Locations
-  Approximate 25' Standard Penetration Test Boring Locations
-  Approximate 20' Standard Penetration Test Boring Locations
-  Approximate 6' Auger Boring Test Locations
-  Approximate 6' Auger Boring Test Locations with Shelby Tubes
-  Approximate Exfiltration Test Locations

BORING LOCATIONS WERE LOCATED USING A MEASURING TAPE AND EXISTING LANDMARKS AS REFERENCE POINTS. IN ADDITION, THE LATITUDE, LONGITUDE, AND ELEVATION NOTED ON THE BORING LOGS WERE TAKEN FROM GOOGLE EARTH. THEREFORE, LOCATIONS SHOWN ON THE PLAN ARE APPROXIMATE.



Appendix C - Notes Related to Borings

NOTES RELATED TO BORING RECORDS AND GENERALIZED SUBSURFACE PROFILES

1. Groundwater levels (if encountered) were recorded either during or following the boring completion on the date indicated. Fluctuations in groundwater levels are common - see the report text for a discussion.
2. The boring locations were identified in the field by estimated distances and offsets from existing reference marks and/or other site landmarks.
3. The completed boreholes were backfilled to adjacent site grade using drilling spoils and patched with asphalt cold mix in pavement areas.
4. The Log of Boring records represent our interpretation of soil conditions based on visual classification of the soil samples recovered from the borings.
5. The Log of Boring records are subject to the limitations, conclusions, and recommendations presented in the report text.
6. The Standard Penetration Test (SPT) N-values contained on the Log of Boring records refer to the total blow counts of a 140-pound drop hammer falling 30 inches required to drive a split-barrel sampler a total distance of 12 inches into soil strata at specific depth intervals.
7. The Hand Cone Penetrometer (HCP) values contained on Log of Boring records and the Cone Penetration Test (CPT) values contained on the Cone Penetration Sounding logs refer to the cone tip resistance recorded when pushing the cone tip into the soil strata at specific depth intervals.
8. The soil and/or rock strata interfaces shown on the Log of Boring records are approximate and may vary from those shown on the logs. The soil and/or rock descriptions shown on the Log of Boring records refer to conditions at the specific location tested. Soil/rock conditions may vary between test locations.
9. Relative density for coarse-grained soils (sands/gravels) and consistency for fine-grained soils (silts/clays) are described as follows:

Coarse Grained Soils (Sands and Gravels)				Fine Grained Soils (Silts and Clays)			
SPT N-Value	HCP Value (kg/cm ²)	CPT Value (tsf)	Relative Density	SPT N-Value	HCP Value (kg/cm ²)	CPT Value (tsf)	Consistency
0-4	0-16	0-20	Very Loose	0-2	0-20	0-3	Very Soft
5-10	17-36	21-40	Loose	3-4	21-35	4-6	Soft
11-30	37-116	41-120	Med. Dense	5-8	>35	7-12	Firm
31-50	117-196	121-200	Dense	9-15		13-25	Stiff
>50	> 196	>200	Very Dense	16-30		26-50	Very Stiff
				>30		>50	Hard

10. Grain size descriptions are as follows:

Description	Particle Size Limits
Boulder	Greater than 12 inches
Cobble	3 to 12 inches
Coarse Gravel	³ / ₄ to 3 inches
Fine Gravel	No. 4 sieve to ³ / ₄ inch
Coarse Sand	No. 10 to No. 4 sieve
Medium Sand	No. 40 to No. 10 sieve
Fine Sand	No. 200 to No. 40 sieve
Fines (Silt/Clay)	Smaller than No. 200 sieve

11. Definitions for modifiers used in soil/rock descriptions:

Proportion	Modifier	Approximate Root Diameter	Modifier
<5%	Trace	Less than ¹ / ₃₂ "	Fine roots
5% to 12%	Little	¹ / ₃₂ " to ¹ / ₄ "	Small roots
12% to 30%	Some	¹ / ₄ " to 1"	Medium roots
30% to 50%	And	Greater than 1"	Large roots
Organic Soils: Soils containing vegetative tissue in various stages of decomposition having a fibrous to amorphous texture. Usually having a dark brown to black color and an organic odor.			
Organic Content Modifiers: <25%: Slightly to Highly Organic; 25% to 75%: Muck; >75%: Peat			

Appendix D - Log of Boring Records

SPT LOGS - GFA DATA TEMPLATE.GDT - 9/27/23 18:11 - G:\PROJECTS\UES PROJECT SETUP\2021 UES PROJECTS\3330.2100102.0000 - COSTCO KANNER HIGHWAY PUD - GEO\17-4455.01 - COSTCO - STUART - GEO\GEO - RESIDENTIAL BUILDINGS\APPENDIC



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LOG OF BORING CR-1

PAGE 1 OF 1

CLIENT	M&M Stuart, LLC.	PROJECT NAME	Costco Kanner Highway	
PROJECT NUMBER	3330.2100102.0000	PROJECT LOCATION	S Kanner Highway, Stuart, Florida	
DRILLING CONTRACTOR	Universal Engineering Sciences	HOLE DEPTH	20 ft	HOLE DIAMETER 3 in
DRILLER	RV/MR/MP	DATE STARTED	6/30/23	COMPLETED 6/30/23
DRILL RIG	GeoProbe	GROUND WATER LEVEL: ∇ AT TIME OF DRILLING	6.00 ft	
METHOD	SPT	LATITUDE	27.165276	LONGITUDE -80.249006
NOTE:	HAMMER TYPE			

DEPTH (ft)	SAMPLE TYPE SAMPLE NUMBER	% RECOVERY (RQD)	BLOW COUNTS	N VALUE	GRAPHIC LOG	MATERIAL DESCRIPTION	LIQUID PLASTIC LIMITS	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
	1		2 5 4	8		Gray fine sand (SP) 2.0				
	2		3 5 6	11		Brown fine sand with little silt (SP-SM) 4.0				
5	3		4 3 4 3	7		Brown fine sand (SP) ∇				
	4		5 5 5 4	10						
	5		3 5 5 5	10						
10										
	6		3 4 6	10						
15										
	7		5 6 5	11		18.5 Light brown fine sand (SP) 20.0				

Bottom of borehole at 20.0 feet.



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LOG OF BORING CR-2

PAGE 1 OF 1

CLIENT <u>M&M Stuart, LLC.</u>	PROJECT NAME <u>Costco Kanner Highway</u>
PROJECT NUMBER <u>3330.2100102.0000</u>	PROJECT LOCATION <u>S Kanner Highway, Stuart, Florida</u>
DRILLING CONTRACTOR <u>Universal Engineering Sciences</u>	HOLE DEPTH <u>20 ft</u> HOLE DIAMETER <u>3 in</u>
DRILLER <u>RV/JQ</u>	DATE STARTED <u>6/29/23</u> COMPLETED <u>6/29/23</u>
DRILL RIG <u>GeoProbe</u>	GROUND WATER LEVEL: <u>▽</u> AT TIME OF DRILLING <u>6.00 ft</u>
METHOD <u>SPT</u>	LATITUDE <u>27.166553</u> LONGITUDE <u>-80.248398</u>
NOTE: _____	HAMMER TYPE _____

DEPTH (ft)	SAMPLE TYPE SAMPLE NUMBER	% RECOVERY (RQD)	BLOW COUNTS	N VALUE	GRAPHIC LOG	MATERIAL DESCRIPTION	LIQUID PLASTIC LIMITS	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
	1		2 3 4 4 5	7		Brown fine sand (SP) 2.0				
	2		4 5 3 3 4	8		Brown fine sand with little silt (SP-SM) 4.0				
5	3		4 3 4 4 5	7		Gray fine sand with little silt (SP-SM) 6.0 ▽				
	4		2 3 5 5 4	8		Dark gray fine sand with little silt (SP-SM) 8.0				
10	5		4 5 5 5 5	10		Gray fine sand (SP) 13.5				
15	6		2 2 5	7		Light brown fine sand (SP)				
20	7		4 4 6	10						

Bottom of borehole at 20.0 feet.

SPT LOGS - GFA DATA TEMPLATE.GDT - 9/27/23 18:11 - G:\PROJECTS\UES PROJECT SETUP\2021 UES PROJECTS\3330.2100102.0000 - COSTCO KANNER HIGHWAY PUD - GEO\17-4455.01 - COSTCO - STUART - GEO\GEO - RESIDENTIAL BUILDINGS\APPENDIC



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LOG OF BORING CR-3

PAGE 1 OF 1

CLIENT	M&M Stuart, LLC.	PROJECT NAME	Costco Kanner Highway		
PROJECT NUMBER	3330.2100102.0000	PROJECT LOCATION	S Kanner Highway, Stuart, Florida		
DRILLING CONTRACTOR	Universal Engineering Sciences	HOLE DEPTH	20 ft	HOLE DIAMETER	3 in
DRILLER	RV/MR/MP	DATE STARTED	6/30/23	COMPLETED	6/30/23
DRILL RIG	GeoProbe	GROUND WATER LEVEL: ∇ AT TIME OF DRILLING	6.00 ft		
METHOD	SPT	LATITUDE	27.166344	LONGITUDE	-80.248822
NOTE:	HAMMER TYPE				

DEPTH (ft)	SAMPLE TYPE SAMPLE NUMBER	% RECOVERY (RQD)	BLOW COUNTS	N VALUE	GRAPHIC LOG	MATERIAL DESCRIPTION	LIQUID PLASTIC LIMITS	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
	1		1 3 5	6		Gray fine sand (SP) 2.0				
	2		4 5 5	10		Dark brown fine sand with little silt, trace fine roots (SP-SM) 4.0				
5	3		4 4 4	8		Brown fine sand (SP) ∇				
	4		3 5 3	9						
	5		2 4 3	9						
10										
	6		3 3 5	8						
15										
	7		4 6 5	11		Light brown fine sand (SP) 18.5 20.0				

Bottom of borehole at 20.0 feet.

SPT LOGS - GFA DATA TEMPLATE.GDT - 9/27/23 18:11 - G:\PROJECTS\UES PROJECT SETUP\2021 UES PROJECTS\3330.2100102.0000 - COSTCO KANNER HIGHWAY PUD - GEO\17-4455.01 - COSTCO - STUART - GEO\GEO - RESIDENTIAL BUILDINGS\APPENDIC



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LOG OF BORING CR-4

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CLIENT	M&M Stuart, LLC.	PROJECT NAME	Costco Kanner Highway	
PROJECT NUMBER	3330.2100102.0000	PROJECT LOCATION	S Kanner Highway, Stuart, Florida	
DRILLING CONTRACTOR	Universal Engineering Sciences	HOLE DEPTH	20 ft	HOLE DIAMETER 3 in
DRILLER	RV/MR/MP	DATE STARTED	6/30/23	COMPLETED 6/30/23
DRILL RIG	GeoProbe	GROUND WATER LEVEL: ∇ AT TIME OF DRILLING	7.00 ft	
METHOD	SPT	LATITUDE	27.166097	LONGITUDE -80.249317
NOTE:	HAMMER TYPE			

DEPTH (ft)	SAMPLE TYPE SAMPLE NUMBER	% RECOVERY (RQD)	BLOW COUNTS	N VALUE	GRAPHIC LOG	MATERIAL DESCRIPTION	LIQUID PLASTIC LIMITS	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
	1		2 4 3 3	7		Gray fine sand (SP) 2.0				
	2		4 4 6	8		Dark brown fine sand with little silt, trace fine roots (SP-SM) 4.0				
5	3		5 4 3 5	7		Brown fine sand with little silt (SP-SM) 6.0				
	4		4 4 6	8		∇ Brown fine sand (SP)				
	5		5 5 7	10						
10										
	6		4 4 6	10						
15										
	7		5 6 6	12		18.5 Light brown fine sand (SP) 20.0				

Bottom of borehole at 20.0 feet.

SPT LOGS - GFA DATA TEMPLATE.GDT - 9/27/23 18:11 - G:\PROJECTS\UES PROJECT SETUP\2021 UES PROJECTS\3330.2100102.0000 - COSTCO KANNER HIGHWAY PUD - GEO\17-4455.01 - COSTCO - STUART - GEO\GEO - RESIDENTIAL BUILDINGS\APPENDIX



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LOG OF BORING CR-5

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CLIENT	M&M Stuart, LLC.	PROJECT NAME	Costco Kanner Highway	
PROJECT NUMBER	3330.2100102.0000	PROJECT LOCATION	S Kanner Highway, Stuart, Florida	
DRILLING CONTRACTOR	Universal Engineering Sciences	HOLE DEPTH	20 ft	HOLE DIAMETER 3 in
DRILLER	CS/BS	DATE STARTED	9/25/23	COMPLETED 9/25/23
DRILL RIG	CME-45	GROUND WATER LEVEL: ∇ AT TIME OF DRILLING	3.30 ft	
METHOD	SPT	LATITUDE	27.165136	LONGITUDE -80.249042
NOTE:	HAMMER TYPE			

DEPTH (ft)	SAMPLE TYPE SAMPLE NUMBER	% RECOVERY (RQD)	BLOW COUNTS	N VALUE	GRAPHIC LOG	MATERIAL DESCRIPTION	LIQUID PLASTIC LIMITS	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
	1		2 3 5	6		Brown fine sand (SP)				
	2		5 7 9	15		3.0 ∇ Gray fine sand (SP)				
5	3		7 10 9	19						
	4		7 6 5	12		6.5 Gray fine sand, little clay (SP-SC)				
	5		5 5 5	10		8.5 Light brown fine sand, little clay (SP-SC)				
10										
	6		4 5 6	11		13.5 Dark brown fine sand (SP)				
15										
	7		4 4 4	8		20.0				
20										

Bottom of borehole at 20.0 feet.



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LOG OF BORING CR-6

PAGE 1 OF 1

CLIENT <u>M&M Stuart, LLC.</u>	PROJECT NAME <u>Costco Kanner Highway</u>
PROJECT NUMBER <u>3330.2100102.0000</u>	PROJECT LOCATION <u>S Kanner Highway, Stuart, Florida</u>
DRILLING CONTRACTOR <u>Universal Engineering Sciences</u>	HOLE DEPTH <u>20 ft</u> HOLE DIAMETER <u>3 in</u>
DRILLER <u>SC/CS</u>	DATE STARTED <u>9/22/23</u> COMPLETED <u>9/22/23</u>
DRILL RIG <u>CME-45</u>	GROUND WATER LEVEL: <u>▽</u> AT TIME OF DRILLING <u>4.30 ft</u>
METHOD <u>SPT</u>	LATITUDE <u>27.165809</u> LONGITUDE <u>-80.248606</u>
NOTE: _____	HAMMER TYPE _____

DEPTH (ft)	SAMPLE TYPE SAMPLE NUMBER	% RECOVERY (RQD)	BLOW COUNTS	N VALUE	GRAPHIC LOG	MATERIAL DESCRIPTION	LIQUID PLASTIC LIMITS	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
5										

Bottom of borehole at 20.0 feet.

SPT LOGS - GFA DATA TEMPLATE.GDT - 9/27/23 18:11 - G:\PROJECTS\UES PROJECT SETUP\2021 UES PROJECTS\3330.2100102.0000 - COSTCO KANNER HIGHWAY PUD - GEO\17-4455.01 - COSTCO - STUART - GEOGEO - RESIDENTIAL BUILDINGS\APPENDIC



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LOG OF BORING CR-7

PAGE 1 OF 1

CLIENT	M&M Stuart, LLC.	PROJECT NAME	Costco Kanner Highway		
PROJECT NUMBER	3330.2100102.0000	PROJECT LOCATION	S Kanner Highway, Stuart, Florida		
DRILLING CONTRACTOR	Universal Engineering Sciences	HOLE DEPTH	20 ft	HOLE DIAMETER	3 in
DRILLER	CS/BS	DATE STARTED	9/25/23	COMPLETED	9/25/23
DRILL RIG	CME-45	GROUND WATER LEVEL: ∇ AT TIME OF DRILLING	2.50 ft		
METHOD	SPT	LATITUDE	27.166112	LONGITUDE	-80.248784
NOTE:	HAMMER TYPE				

DEPTH (ft)	SAMPLE TYPE SAMPLE NUMBER	% RECOVERY (RQD)	BLOW COUNTS	N VALUE	GRAPHIC LOG	MATERIAL DESCRIPTION	LIQUID PLASTIC LIMITS	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
5										



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LOG OF BORING CR-8

PAGE 1 OF 1

CLIENT <u>M&M Stuart, LLC.</u>	PROJECT NAME <u>Costco Kanner Highway</u>
PROJECT NUMBER <u>3330.2100102.0000</u>	PROJECT LOCATION <u>S Kanner Highway, Stuart, Florida</u>
DRILLING CONTRACTOR <u>Universal Engineering Sciences</u>	HOLE DEPTH <u>20 ft</u> HOLE DIAMETER <u>3 in</u>
DRILLER <u>CS/BS</u>	DATE STARTED <u>9/25/23</u> COMPLETED <u>9/25/23</u>
DRILL RIG <u>CME-45</u>	GROUND WATER LEVEL: <u>▽</u> AT TIME OF DRILLING <u>2.25 ft</u>
METHOD <u>SPT</u>	LATITUDE <u>27.166203</u> LONGITUDE <u>-80.249248</u>
NOTE: _____	HAMMER TYPE _____

DEPTH (ft)	SAMPLE TYPE SAMPLE NUMBER	% RECOVERY (RQD)	BLOW COUNTS	N VALUE	GRAPHIC LOG	MATERIAL DESCRIPTION	LIQUID PLASTIC LIMITS	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
	1		1 1 2 3	3		Brown fine sand (SP)				
	2		5 9 12 15	21		▽				
5	3		10 11 9 8	20		5.0 Brown-gray fine sand (SP)				
	4		7 7 6 6	13		7.0 Gray fine sand, little clay (SP-SC)				
	5		5 5 5 5	10		8.5 Light brown fine sand, little clay (SP-SC)				
10										
	6		4 4 6	10		13.5 Dark brown fine sand (SP)				
15										
	7		5 6 6	12		18.5 Light brown fine sand (SP)				
20						20.0				

Bottom of borehole at 20.0 feet.



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LOG OF BORING L-01

PAGE 1 OF 1

CLIENT <u>M&M Stuart, LLC.</u>	PROJECT NAME <u>Costco Kanner Highway</u>
PROJECT NUMBER <u>3330.2100102.0000</u>	PROJECT LOCATION <u>S Kanner Highway, Stuart, Florida</u>
DRILLING CONTRACTOR <u>Universal Engineering Sciences</u>	HOLE DEPTH <u>30 ft</u> HOLE DIAMETER <u>3 in</u>
DRILLER <u>CS/BS</u>	DATE STARTED <u>6/30/23</u> COMPLETED <u>6/30/23</u>
DRILL RIG <u>CME-45</u>	GROUND WATER LEVEL: <u>▽ AT TIME OF DRILLING</u> <u>2.60 ft</u>
METHOD <u>SPT</u>	LATITUDE <u>27.167346</u> LONGITUDE <u>-80.244996</u>
NOTE: _____	HAMMER TYPE _____

DEPTH (ft)	SAMPLE TYPE SAMPLE NUMBER	% RECOVERY (RQD)	BLOW COUNTS	N VALUE	GRAPHIC LOG	MATERIAL DESCRIPTION	LIQUID PLASTIC LIMITS	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
	1		1 2 4 5	6		Brown fine sand (SP)				
	2		7 10 11 11	21		2.0 ▽ Light brown fine sand (SP)				
5	3		5 5 7 8	12		4.5 Brown fine sand with little silt (SP-SM)				
	4		9 7 9 9	16		6.5 Brown fine sand (SP)				
10	5		4 5 5 5	10						
	6		3 3 4	7						
	7		4 5 5	10						
15						16.0				
	8		4 4 5	9		Light brown fine sand (SP)				
						18.5				
20	9		5 5 6	11		Gray-light brown fine sand (SP)				
	10		4 4 3	7						
						23.5				
25	11		4 4 4	8		Brown fine sand (SP)				
						26.0				
	12		4 4 5	9		Light gray fine sand with little silt (SP-SM)				
						28.5				
	13		4 4 3	7		Light brown fine sand (SP)				
30						30.0				

Bottom of borehole at 30.0 feet.

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LOG OF BORING L-02

PAGE 1 OF 1

CLIENT	M&M Stuart, LLC.	PROJECT NAME	Costco Kanner Highway		
PROJECT NUMBER	3330.2100102.0000	PROJECT LOCATION	S Kanner Highway, Stuart, Florida		
DRILLING CONTRACTOR	Universal Engineering Sciences	HOLE DEPTH	30 ft	HOLE DIAMETER	3 in
DRILLER	CS/BS	DATE STARTED	6/30/23	COMPLETED	6/30/23
DRILL RIG	CME-45	GROUND WATER LEVEL:	AT TIME OF DRILLING	---	
METHOD	SPT	LATITUDE	27.167937	LONGITUDE	-80.245248
NOTE:	HAMMER TYPE				

DEPTH (ft)	SAMPLE TYPE SAMPLE NUMBER	% RECOVERY (RQD)	BLOW COUNTS	N VALUE	GRAPHIC LOG	MATERIAL DESCRIPTION	LIQUID PLASTIC LIMITS	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
	1		2 2 4 6	6		Gray fine sand (SP)				
	2		6 8 10 12	18		2.5 Light gray fine sand (SP)				
5	3		6 7 8 8	15		5.0 Brown fine sand (SP)				
	4		8 7 7 6	14						
	5		5 5 4 4	9						
10										
	6		4 3 4	7						
	7		4 4 4	8						
15										
	8		3 4 3	7		16.0 Light brown fine sand (SP)				
	9		4 4 4	8						
20										
	10		4 4 4	8		21.0 Brown fine sand (SP)				
	11		3 3 4	7		23.5 Light brown fine sand (SP)				
25										
	12		4 4 4	8		26.0 Light gray fine sand (SP)				
	13		3 3 4	7		30.0				

30

Bottom of borehole at 30.0 feet.

SPT LOGS - GFA DATA TEMPLATE.GDT - 9/27/23 18:11 - G:\PROJECTS\UES PROJECT SETUP\2021 UES PROJECTS\3330.2100102.0000 - COSTCO KANNER HIGHWAY PUD - GEO\17-4455.01 - COSTCO - STUART - GEO\GEO - RESIDENTIAL BUILDINGS\APPENDIC



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LOG OF BORING L-03

PAGE 1 OF 1

CLIENT	M&M Stuart, LLC.	PROJECT NAME	Costco Kanner Highway		
PROJECT NUMBER	3330.2100102.0000	PROJECT LOCATION	S Kanner Highway, Stuart, Florida		
DRILLING CONTRACTOR	Universal Engineering Sciences	HOLE DEPTH	30 ft	HOLE DIAMETER	3 in
DRILLER	CS/BS	DATE STARTED	7/5/23	COMPLETED	7/5/23
DRILL RIG	CME-45	GROUND WATER LEVEL: ∇ AT TIME OF DRILLING	4.40 ft		
METHOD	SPT	LATITUDE	27.166448	LONGITUDE	-80.246018
NOTE:	HAMMER TYPE				

DEPTH (ft)	SAMPLE TYPE SAMPLE NUMBER	% RECOVERY (RQD)	BLOW COUNTS	N VALUE	GRAPHIC LOG	MATERIAL DESCRIPTION	LIQUID PLASTIC LIMITS	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
	1		1 2 4 4	6		Light gray fine sand (SP)				
	2		5 8 10 10	18		2.5 Brown fine sand (SP)				
5	3		6 6 7 7	13		∇				
	4		4 4 5 6	9						
10	5		6 6 7 8	13						
	6		5 5 5	10						
15	7		4 5 7	12						
	8		5 5 4	9		16.0 Gray-light brown fine sand (SP)				
	9		4 4 5	9		18.5 Light brown fine sand (SP)				
20	10		5 5 5	10		21.0 Gray-light brown fine sand (SP)				
	11		6 5 6	11						
25	12		3 3 2	5		26.0 Light gray fine sand (SP)				
	13		2 2 2	4		30.0				

Bottom of borehole at 30.0 feet.

SPT LOGS - GFA DATA TEMPLATE.GDT - 9/27/23 18:11 - G:\PROJECTS\UES PROJECT SETUP\2021 UES PROJECTS\3330.2100102.0000 - COSTCO KANNER HIGHWAY PUD - GEO\17-4455.01 - COSTCO - STUART - GEO\GEO - RESIDENTIAL BUILDINGS\APPENDIX



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LOG OF BORING L-04

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CLIENT	M&M Stuart, LLC.	PROJECT NAME	Costco Kanner Highway		
PROJECT NUMBER	3330.2100102.0000	PROJECT LOCATION	S Kanner Highway, Stuart, Florida		
DRILLING CONTRACTOR	Universal Engineering Sciences	HOLE DEPTH	30 ft	HOLE DIAMETER	3 in
DRILLER	RV/JQ	DATE STARTED	6/29/23	COMPLETED	6/29/23
DRILL RIG	GeoProbe	GROUND WATER LEVEL: ∇ AT TIME OF DRILLING	5.00 ft		
METHOD	SPT	LATITUDE	27.166035	LONGITUDE	-80.247289
NOTE:	HAMMER TYPE				

DEPTH (ft)	SAMPLE TYPE SAMPLE NUMBER	% RECOVERY (RQD)	BLOW COUNTS	N VALUE	GRAPHIC LOG	MATERIAL DESCRIPTION	LIQUID PLASTIC LIMITS	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
	1		2 3 4 6	7		Light gray fine sand (SP)				
	2		2 5 4 5	9		4.0				
5	3		5 7 10 12	17		∇ Brown fine sand (SP)				
	4		3 3 3 3	6		8.0				
	5		3 3 4 4	7		Gray fine sand (SP)				
10						11.0				
	6		2 3 3	6		Brown fine sand (SP)				
	7		3 3 2	5						
15										
	8		2 2 2	4						
						18.5				
	9		2 1 2	3		Brown fine sand with little silt (SP-SM)				
20						21.0				
	10		5 6 7	13		Gray fine sand (SP)				
	11		4 6 5	11						
25										
	12		5 6 6	12						
	13		6 7 5	12						
30						30.0				

Bottom of borehole at 30.0 feet.

SPT LOGS - GFA DATA TEMPLATE.GDT - 9/27/23 18:11 - G:\PROJECTS\UES PROJECT SETUP\2021 UES PROJECTS\3330.2100102.0000 - COSTCO KANNER HIGHWAY PUD - GEO\17-4455.01 - COSTCO - STUART - GEOGEO - RESIDENTIAL BUILDINGS\APPENDIX



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LOG OF BORING L-05

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CLIENT <u>M&M Stuart, LLC.</u>	PROJECT NAME <u>Costco Kanner Highway</u>
PROJECT NUMBER <u>3330.2100102.0000</u>	PROJECT LOCATION <u>S Kanner Highway, Stuart, Florida</u>
DRILLING CONTRACTOR <u>Universal Engineering Sciences</u>	HOLE DEPTH <u>30 ft</u> HOLE DIAMETER <u>3 in</u>
DRILLER <u>CS/Jq</u>	DATE STARTED <u>9/19/23</u> COMPLETED <u>9/19/23</u>
DRILL RIG <u>CME-45</u>	GROUND WATER LEVEL: <u>▽</u> AT TIME OF DRILLING <u>4.70 ft</u>
METHOD <u>SPT</u>	LATITUDE <u>27.16374</u> LONGITUDE <u>-80.248398</u>
NOTE: _____	HAMMER TYPE _____

DEPTH (ft)	SAMPLE TYPE SAMPLE NUMBER	% RECOVERY (RQD)	BLOW COUNTS	N VALUE	GRAPHIC LOG	MATERIAL DESCRIPTION	LIQUID PLASTIC LIMITS	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
	1		3 5 6 6	11		Dark brown fine sand, little silt (SP-SM)				
	2		6 8 11 9	19		3.0 Dark gray fine sand, trace roots (SP)				
5	3		9 10 11 11	21		5.0 Gray fine sand (SP)				
	4		10 11 10 9	21						
	5		8 7 7 6	14		9.0 Dark brown fine sand, some silt (SM)				
10	6		4 4 4	8		11.0 Light brown fine sand (SP)				
	7		3 3 4	7		16.0				
15	8		3 4 4	8		18.5 Gray fine sand (SP)				
	9		4 4 4	8		21.0 Light brown-gray fine sand (SP)				
20	10		2 2 2	4		26.0 Gray-brown fine sand (SP)				
	11		2 2 2	4						
25	12		3 2 3	5						
	13		2 3 3	6		30.0 Gray fine sand (SP)				

30

Bottom of borehole at 30.0 feet.

SPT LOGS - GFA DATA TEMPLATE.GDT - 9/27/23 18:11 - G:\PROJECTS\UES PROJECT SETUP\2021 UES PROJECTS\3330.2100102.0000 - COSTCO KANNER HIGHWAY PUD - GEO\17-4455.01 - COSTCO - STUART - GEO\GEO - RESIDENTIAL BUILDINGS\APPENDIX



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LOG OF BORING R-01

PAGE 1 OF 1

CLIENT	M&M Stuart, LLC.	PROJECT NAME	Costco Kanner Highway	
PROJECT NUMBER	3330.2100102.0000	PROJECT LOCATION	S Kanner Highway, Stuart, Florida	
DRILLING CONTRACTOR	Universal Engineering Sciences	HOLE DEPTH	25 ft	HOLE DIAMETER 3 in
DRILLER	RV/JQ	DATE STARTED	6/29/23	COMPLETED 6/29/23
DRILL RIG	GeoProbe	GROUND WATER LEVEL: ∇ AT TIME OF DRILLING	6.00 ft	
METHOD	SPT	LATITUDE	27.165822	LONGITUDE -80.247688
NOTE:	HAMMER TYPE			

DEPTH (ft)	SAMPLE TYPE SAMPLE NUMBER	% RECOVERY (RQD)	BLOW COUNTS	N VALUE	GRAPHIC LOG	MATERIAL DESCRIPTION	LIQUID PLASTIC LIMITS	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
	1		1 3 4 5	7		Dark brown organically stained fine sand with little silt (SP-SM) 2.0				
	2		3 3 4 6	7		Brown fine sand, some silt (SM) 4.0				
5	3		3 4 4 4	8		Gray fine sand with little silt, trace fine root (SP-SM) 6.0 ∇				
	4		3 4 5 4	9		Light brown fine sand (SP) 8.0				
	5		4 4 5 6	9		Brown fine sand (SP)				
10										
	6		2 3 3 3	6		Light brown fine sand (SP) 13.5				
15										
	7		3 4 7	11						
20										
	8		3 5 4	9		Gray fine sand (SP) 23.5				
25						25.0				

Bottom of borehole at 25.0 feet.



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LOG OF BORING R-02

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CLIENT <u>M&M Stuart, LLC.</u>	PROJECT NAME <u>Costco Kanner Highway</u>
PROJECT NUMBER <u>3330.2100102.0000</u>	PROJECT LOCATION <u>S Kanner Highway, Stuart, Florida</u>
DRILLING CONTRACTOR <u>Universal Engineering Sciences</u>	HOLE DEPTH <u>25 ft</u> HOLE DIAMETER <u>3 in</u>
DRILLER <u>RV/JQ</u>	DATE STARTED <u>6/29/23</u> COMPLETED <u>6/29/23</u>
DRILL RIG <u>GeoProbe</u>	GROUND WATER LEVEL: <u>▽</u> AT TIME OF DRILLING <u>6.00 ft</u>
METHOD <u>SPT</u>	LATITUDE <u>27.166544</u> LONGITUDE <u>-80.248157</u>
NOTE: _____	HAMMER TYPE _____

DEPTH (ft)	SAMPLE TYPE SAMPLE NUMBER	% RECOVERY (RQD)	BLOW COUNTS	N VALUE	GRAPHIC LOG	MATERIAL DESCRIPTION	LIQUID PLASTIC LIMITS	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
	1		2 3 4	6		Dark brown organically stained fine sand with little silt (SP-SM)				
	2		3 4 4	8		Brown fine sand, some silt (SM)				
5	3		2 3 4 4	7		Gray fine sand with little silt, trace fine roots (SP-SM)				
	4		5 4 5 4	9		Brown fine sand (SP)				
	5		4 5 6 5	11		Gray fine sand (SP)				
10										
	6		1 3 4	7		Light brown fine sand (SP)				
15										
	7		2 4 5	9						
20										
	8		3 3 6	9		Gray fine sand (SP)				
25										

Bottom of borehole at 25.0 feet.



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LOG OF BORING R-03

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CLIENT M&M Stuart, LLC. PROJECT NAME Costco Kanner Highway
PROJECT NUMBER 3330.2100102.0000 PROJECT LOCATION S Kanner Highway, Stuart, Florida
DRILLING CONTRACTOR Universal Engineering Sciences HOLE DEPTH 25 ft HOLE DIAMETER 3 in
DRILLER CS/BS DATE STARTED 9/21/23 COMPLETED 9/21/23
DRILL RIG CME-45 GROUND WATER LEVEL: ▽ AT TIME OF DRILLING 3.75 ft
METHOD SPT LATITUDE 27.16694 LONGITUDE -80.247177
NOTE: _____ HAMMER TYPE _____

DEPTH (ft)	SAMPLE TYPE SAMPLE NUMBER	% RECOVERY (RQD)	BLOW COUNTS	N VALUE	GRAPHIC LOG	MATERIAL DESCRIPTION	LIQUID PLASTIC LIMITS	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
	1		2 2 3 4	5		Dark brown fine sand (SP)				
	2		7 11 12 15	23		2.5 Gray fine sand, trace root fibers (SP) ▽				
5	3		11 11 9 8	20		5.0 Dark brown fine sand, little silt (SP-SM)				
	4		7 7 7 7	14		6.5 Gray fine sand (SP)				
	5		5 4 4 4	8		8.5 Dark brown fine sand (SP)				
10										
	6		4 4 5	9		13.5 Gray fine sand (SP)				
15										
	7		4 4 3	7		18.5 Brown fine sand (SP)				
20										
	8		3 3 3	6		23.5 Light brown fine sand (SP)				
25						25.0 Bottom of borehole at 25.0 feet.				

SPT LOGS - GFA DATA TEMPLATE.GDT - 9/27/23 18:11 - G:\PROJECTS\UES PROJECT SETUP\2021 UES PROJECTS\3330.2100102.0000 - COSTCO KANNER HIGHWAY PUD - GEO\17-4455.01 - COSTCO - STUART - GEO\GEO - RESIDENTIAL BUILDINGS\APPENDIX



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LOG OF BORING R-04

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CLIENT	M&M Stuart, LLC.	PROJECT NAME	Costco Kanner Highway	
PROJECT NUMBER	3330.2100102.0000	PROJECT LOCATION	S Kanner Highway, Stuart, Florida	
DRILLING CONTRACTOR	Universal Engineering Sciences	HOLE DEPTH	25 ft	HOLE DIAMETER 3 in
DRILLER	RV/JQ	DATE STARTED	6/29/23	COMPLETED 6/29/23
DRILL RIG	GeoProbe	GROUND WATER LEVEL: ∇ AT TIME OF DRILLING	6.00 ft	
METHOD	SPT	LATITUDE	27.166421	LONGITUDE -80.24679
NOTE:	HAMMER TYPE			

DEPTH (ft)	SAMPLE TYPE SAMPLE NUMBER	% RECOVERY (RQD)	BLOW COUNTS	N VALUE	GRAPHIC LOG	MATERIAL DESCRIPTION	LIQUID PLASTIC LIMITS	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
	1		2 3 5	6		Light gray fine sand (SP)				
	2		3 5 8	8		4.0				
5	3		5 6 6	12		Brown fine sand (SP)				
	4		4 5 4	8		6.0 ∇ Brown fine sand with little silt (SP-SM)				
	5		3 3 5	6		8.0 Gray fine sand (SP)				
10										
	6		2 3 4	7						
15										
	7		2 3 3	6		18.5 Dark brown fine sand (SP)				
20										
	8		4 5 6	11		23.5 Gray fine sand (SP)				
25						25.0				

Bottom of borehole at 25.0 feet.



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CLIENT <u>M&M Stuart, LLC.</u>	PROJECT NAME <u>Costco Kanner Highway</u>
PROJECT NUMBER <u>3330.2100102.0000</u>	PROJECT LOCATION <u>S Kanner Highway, Stuart, Florida</u>
DRILLING CONTRACTOR <u>Universal Engineering Sciences</u>	HOLE DEPTH <u>25 ft</u> HOLE DIAMETER <u>3 in</u>
DRILLER <u>CS/BS</u>	DATE STARTED <u>6/30/23</u> COMPLETED <u>6/30/23</u>
DRILL RIG <u>CME-45</u>	GROUND WATER LEVEL: <u>▽</u> AT TIME OF DRILLING <u>5.70 ft</u>
METHOD <u>SPT</u>	LATITUDE <u>27.166579</u> LONGITUDE <u>-80.246346</u>
NOTE: _____	HAMMER TYPE _____

DEPTH (ft)	SAMPLE TYPE SAMPLE NUMBER	% RECOVERY (RQD)	BLOW COUNTS	N VALUE	GRAPHIC LOG	MATERIAL DESCRIPTION	LIQUID PLASTIC LIMITS	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)		
5	1		1 2 4 5	6		Light gray fine sand (SP)						
	2		5 4 5 5	9								
	3		5 5 6 6	11		▽						
	4		6 9 10 10	19		7.5						
10	5		6 5 6 6	11							Dark gray fine sand (SP)	
											Brown fine sand (SP)	
15	6		2 3 4	7								
20												
	7		2 2 2	4		18.5	Dark brown fine sand, trace organics (SP)					
	8		2 2 2	4		23.5	Brown fine sand (SP)					
						25.0						

Bottom of borehole at 25.0 feet.

SPT LOGS - GFA DATA TEMPLATE.GDT - 9/27/23 18:11 - G:\PROJECTS\UES PROJECT SETUP\2021 UES PROJECTS\3330.2100102.0000 - COSTCO KANNER HIGHWAY PUD - GEO\17-4455.01 - COSTCO - STUART - GEO\GEO - RESIDENTIAL BUILDINGS\APPENDIX



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CLIENT	M&M Stuart, LLC.	PROJECT NAME	Costco Kanner Highway		
PROJECT NUMBER	3330.2100102.0000	PROJECT LOCATION	S Kanner Highway, Stuart, Florida		
DRILLING CONTRACTOR	Universal Engineering Sciences	HOLE DEPTH	25 ft	HOLE DIAMETER	3 in
DRILLER	CS/BS	DATE STARTED	6/29/23	COMPLETED	6/29/23
DRILL RIG	CME-45	GROUND WATER LEVEL: ∇ AT TIME OF DRILLING	3.90 ft		
METHOD	SPT	LATITUDE	27.167288	LONGITUDE	-80.246154
NOTE:	HAMMER TYPE				

DEPTH (ft)	SAMPLE TYPE SAMPLE NUMBER	% RECOVERY (RQD)	BLOW COUNTS	N VALUE	GRAPHIC LOG	MATERIAL DESCRIPTION	LIQUID PLASTIC LIMITS	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
	1		2 2 3 5	5		Light gray fine sand (SP)				
	2		5 6 6 7	12		∇				
5	3		6 7 8 8	15		5.0 Brown fine sand (SP)				
	4		6 8 7 8	15		6.5 Light brown fine sand with little silt (SP-SM)				
	5		5 5 6 5	11		8.0 Brown fine sand (SP)				
10										
	6		4 3 4	7		13.5 Gray fine sand (SP)				
15										
	7		4 4 4	8		18.5 Brown fine sand (SP)				
20										
	8		4 3 3	6		25.0				
25										

Bottom of borehole at 25.0 feet.



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CLIENT <u>M&M Stuart, LLC.</u>	PROJECT NAME <u>Costco Kanner Highway</u>
PROJECT NUMBER <u>3330.2100102.0000</u>	PROJECT LOCATION <u>S Kanner Highway, Stuart, Florida</u>
DRILLING CONTRACTOR <u>Universal Engineering Sciences</u>	HOLE DEPTH <u>25 ft</u> HOLE DIAMETER <u>3 in</u>
DRILLER <u>CS/BS</u>	DATE STARTED <u>6/29/23</u> COMPLETED <u>6/29/23</u>
DRILL RIG <u>CME-45</u>	GROUND WATER LEVEL: <u>▽</u> AT TIME OF DRILLING <u>5.00 ft</u>
METHOD <u>SPT</u>	LATITUDE <u>27.167819</u> LONGITUDE <u>-80.246797</u>
NOTE: _____	HAMMER TYPE _____

DEPTH (ft)	SAMPLE TYPE SAMPLE NUMBER	% RECOVERY (RQD)	BLOW COUNTS	N VALUE	GRAPHIC LOG	MATERIAL DESCRIPTION	LIQUID PLASTIC LIMITS	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
	1		2 2 4 5	6		Light gray fine sand (SP)				
	2		4 5 4 5	9						
5	3		4 4 8 11	12		4.5 ▽ Brown fine sand (SP)				
	4		6 5 5 5	10		6.5 Light brown fine sand with little silt (SP-SM)				
	5		4 4 4 4	8		8.0 Light brown fine sand (SP)				
10										
	6		1 2 2	4		13.5 Gray fine sand (SP)				
15										
	7		1 0 1	1		18.5 Brown fine sand (SP)				
20										
	8		3 3 3	6		23.5 Light gray fine sand (SP)				
25						25.0				

Bottom of borehole at 25.0 feet.



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CLIENT M&M Stuart, LLC. PROJECT NAME Costco Kanner Highway
PROJECT NUMBER 3330.2100102.0000 PROJECT LOCATION S Kanner Highway, Stuart, Florida
DRILLING CONTRACTOR Universal Engineering Sciences HOLE DEPTH 25 ft HOLE DIAMETER 3 in
DRILLER CS/BS DATE STARTED 6/29/23 COMPLETED 6/29/23
DRILL RIG CME-45 GROUND WATER LEVEL: ▽ AT TIME OF DRILLING 2.40 ft
METHOD SPT LATITUDE 27.167883 LONGITUDE -80.246065
NOTE: _____ HAMMER TYPE _____

DEPTH (ft)	SAMPLE TYPE SAMPLE NUMBER	% RECOVERY (RQD)	BLOW COUNTS	N VALUE	GRAPHIC LOG	MATERIAL DESCRIPTION	LIQUID PLASTIC LIMITS	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
	1		1 3 4 5	7		Light gray fine sand (SP)				
	2		5 7 7 8	14		▽				
5	3		7 7 8 9	15		4.5 Brown organically stained fine sand with little silt (SP-SM)				
	4		7 8 8 8	16		6.0 Brown fine sand with little silt, trace fine root (SP-SM)				
	5		6 6 7 6	13		8.5 Brown fine sand with little silt (SP-SM)				
10										
	6		4 4 4	8		13.5 Light brown fine sand (SP)				
15										
	7		4 5 5	10						
20										
	8		4 4 4	8		23.5 Light brown-gray fine sand (SP)				
25						25.0				

Bottom of borehole at 25.0 feet.



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CLIENT M&M Stuart, LLC. PROJECT NAME Costco Kanner Highway
PROJECT NUMBER 3330.2100102.0000 PROJECT LOCATION S Kanner Highway, Stuart, Florida
DRILLING CONTRACTOR Universal Engineering Sciences HOLE DEPTH 25 ft HOLE DIAMETER 3 in
DRILLER CS/BS DATE STARTED 6/29/23 COMPLETED 6/29/23
DRILL RIG CME-45 GROUND WATER LEVEL: ▽ AT TIME OF DRILLING 2.20 ft
METHOD SPT LATITUDE 27.166784 LONGITUDE -80.245554
NOTE: _____ HAMMER TYPE _____

DEPTH (ft)	SAMPLE TYPE SAMPLE NUMBER	% RECOVERY (RQD)	BLOW COUNTS	N VALUE	GRAPHIC LOG	MATERIAL DESCRIPTION	LIQUID PLASTIC LIMITS	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
	1		2 5 6	8		Light gray fine sand, trace fine root (SP)				
	2		6 7 8	15		2.5▽ Light gray fine sand (SP)				
5	3		7 8 8 9	16		4.5 Dark brown organically stained fine sand with little silt, trace fine roots (SP-SM)				
	4		8 8 9 9	17		6.5 Brown fine sand with little silt (SP-SM)				
	5		7 8 8 8	16		8.0 Brown fine sand (SP)				
10										
	6		4 4 5	9		13.5 Light brown fine sand (SP)				
15										
	7		4 5 7	12						
20										
	8		3 4 4	8		23.5 Brown fine sand (SP)				
25						25.0 Bottom of borehole at 25.0 feet.				



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CLIENT M&M Stuart, LLC. **PROJECT NAME** Costco Kanner Highway
PROJECT NUMBER 3330.2100102.0000 **PROJECT LOCATION** S Kanner Highway, Stuart, Florida
DRILLING CONTRACTOR Universal Engineering Sciences **HOLE DEPTH** 25 ft **HOLE DIAMETER** 3 in
DRILLER CS/BS **DATE STARTED** 6/29/23 **COMPLETED** 6/29/23
DRILL RIG CME-45 **GROUND WATER LEVEL: ∇ AT TIME OF DRILLING** 2.50 ft
METHOD SPT **LATITUDE** 27.166981 **LONGITUDE** -80.245361
NOTE: **HAMMER TYPE**

DEPTH (ft)	SAMPLE TYPE SAMPLE NUMBER	% RECOVERY (RQD)	BLOW COUNTS	N VALUE	GRAPHIC LOG	MATERIAL DESCRIPTION	LIQUID PLASTIC LIMITS	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
	1		1 3 5 5	8		Light gray fine sand (SP)				
	2		5 7 8 9	15		∇				
5	3		6 9 10 12	19		5.0 Brown fine sand with some silt, trace fine root (SM)				
	4		17 23 20 17	43		7.0 Dark brown organically stained fine sand with little silt (SP-SM)				
	5		7 5 5 5	10		8.5 Gray fine sand (SP)				
10										
	6		4 4 5	9		13.5 Brown fine sand (SP)				
15										
	7		4 4 4	8						
20										
	8		3 3 3	6						
25						25.0 Bottom of borehole at 25.0 feet.				

SPT LOGS - GFA DATA TEMPLATE.GDT - 9/27/23 18:11 - G:\PROJECTS\UES PROJECT SETUP\2021 UES PROJECTS\3330.2100102.0000 - COSTCO KANNER HIGHWAY PUD - GEO\17-4455.01 - COSTCO - STUART - GEO\GEO - RESIDENTIAL BUILDINGS\APPENDIX



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CLIENT	M&M Stuart, LLC.	PROJECT NAME	Costco Kanner Highway		
PROJECT NUMBER	3330.2100102.0000	PROJECT LOCATION	S Kanner Highway, Stuart, Florida		
DRILLING CONTRACTOR	Universal Engineering Sciences	HOLE DEPTH	25 ft	HOLE DIAMETER	3 in
DRILLER	SC/CS	DATE STARTED	9/22/23	COMPLETED	9/22/23
DRILL RIG	CME-45	GROUND WATER LEVEL: ∇ AT TIME OF DRILLING	4.20 ft		
METHOD	SPT	LATITUDE	27.166146	LONGITUDE	-80.247995
NOTE:	HAMMER TYPE				

DEPTH (ft)	SAMPLE TYPE SAMPLE NUMBER	% RECOVERY (RQD)	BLOW COUNTS	N VALUE	GRAPHIC LOG	MATERIAL DESCRIPTION	LIQUID PLASTIC LIMITS	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
	1		1 1 2 2	3		Gray fine sand (SP)				
	2		3 3 4 6	7		3.0 Dark brown fine sand, little silt (SP-SM)				
5	3		8 10 12 10	22		5.0 Gray fine sand (SP)				
	4		10 14 16 12	30						
	5		5 5 5 5	10						
10										
	6		3 3 4	7		13.5 Dark brown fine sand (SP)				
15										
	7		3 3 3 3	6						
20										
	8		2 2 2 2	4		25.0				
25										

Bottom of borehole at 25.0 feet.

SPT LOGS - GFA DATA TEMPLATE.GDT - 9/27/23 18:11 - G:\PROJECTS\UES PROJECT SETUP\2021 UES PROJECTS\3330.2100102.0000 - COSTCO KANNER HIGHWAY PUD - GEO\17-4455.01 - COSTCO - STUART - GEOGEO - RESIDENTIAL BUILDINGS\APPENDIC



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CLIENT	M&M Stuart, LLC.	PROJECT NAME	Costco Kanner Highway		
PROJECT NUMBER	3330.2100102.0000	PROJECT LOCATION	S Kanner Highway, Stuart, Florida		
DRILLING CONTRACTOR	Universal Engineering Sciences	HOLE DEPTH	25 ft	HOLE DIAMETER	3 in
DRILLER	CS/BS	DATE STARTED	9/21/23	COMPLETED	9/21/23
DRILL RIG	CME-45	GROUND WATER LEVEL: ∇ AT TIME OF DRILLING	3.90 ft		
METHOD	SPT	LATITUDE	27.166674	LONGITUDE	-80.247527
NOTE:	HAMMER TYPE				

DEPTH (ft)	SAMPLE TYPE SAMPLE NUMBER	% RECOVERY (RQD)	BLOW COUNTS	N VALUE	GRAPHIC LOG	MATERIAL DESCRIPTION	LIQUID PLASTIC LIMITS	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
	1		2 3 4 4	7		Dark brown fine sand, little silt (SP-SM)		10.7	6.6	
	2		5 8 11 12	19		3.0 ∇ Gray fine sand, trace root fibers (SP)				
5	3		10 11 8 7	19		5.5 Dark brown fine sand, little silt (SP-SM)				
	4		7 7 6 6	13		7.0 Gray fine sand (SP)				
10	5		5 4 5 4	9						
						13.5				
15	6		4 4 4	8		Gray fine sand, little silt (SP-SM)				
						18.5				
20	7		3 4 3	7		Brown fine sand (SP)				
						23.5				
						25.0				
25	8		2 3 3	6		Light brown fine sand (SP)				

Bottom of borehole at 25.0 feet.

SPT LOGS - GFA DATA TEMPLATE.GDT - 9/27/23 18:11 - G:\PROJECTS\UES PROJECT SETUP\2021 UES PROJECTS\3330.2100102.0000 - COSTCO KANNER HIGHWAY PUD - GEO\17-4455.01 - COSTCO - STUART - GEO\GEO - RESIDENTIAL BUILDINGS\APPENDIX



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CLIENT	M&M Stuart, LLC.	PROJECT NAME	Costco Kanner Highway		
PROJECT NUMBER	3330.2100102.0000	PROJECT LOCATION	S Kanner Highway, Stuart, Florida		
DRILLING CONTRACTOR	Universal Engineering Sciences	HOLE DEPTH	25 ft	HOLE DIAMETER	3 in
DRILLER	CS/BS	DATE STARTED	9/21/23	COMPLETED	9/21/23
DRILL RIG	CME-45	GROUND WATER LEVEL: ∇ AT TIME OF DRILLING	3.75 ft		
METHOD	SPT	LATITUDE	27.166758	LONGITUDE	-80.246652
NOTE:	HAMMER TYPE				

DEPTH (ft)	SAMPLE TYPE SAMPLE NUMBER	% RECOVERY (RQD)	BLOW COUNTS	N VALUE	GRAPHIC LOG	MATERIAL DESCRIPTION	LIQUID PLASTIC LIMITS	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
	1		3 4 8 10	12		Light gray fine sand (SP)				
	2		8 7 7 8	14		∇				
5	3		6 5 4 4	9		5.0 Gray fine sand, some clay, trace root fibers (SC)				
	4		3 3 4 6	7		6.5 Brown fine sand (SP)				
	5		6 6 7 7	13						
10										
	6		3 3 4	7						
15										
	7		2 2 2	4						
20										
	8		3 3 4	7		23.5 Gray fine sand (SP)				
25						25.0				

Bottom of borehole at 25.0 feet.



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CLIENT <u>M&M Stuart, LLC.</u>	PROJECT NAME <u>Costco Kanner Highway</u>
PROJECT NUMBER <u>3330.2100102.0000</u>	PROJECT LOCATION <u>S Kanner Highway, Stuart, Florida</u>
DRILLING CONTRACTOR <u>Universal Engineering Sciences</u>	HOLE DEPTH <u>25 ft</u> HOLE DIAMETER <u>3 in</u>
DRILLER <u>CS/BS</u>	DATE STARTED <u>9/21/23</u> COMPLETED <u>9/21/23</u>
DRILL RIG <u>CME-45</u>	GROUND WATER LEVEL: <u>▽</u> AT TIME OF DRILLING <u>4.10 ft</u>
METHOD <u>SPT</u>	LATITUDE <u>27.167064</u> LONGITUDE <u>-80.246364</u>
NOTE: _____	HAMMER TYPE _____

DEPTH (ft)	SAMPLE TYPE SAMPLE NUMBER	% RECOVERY (RQD)	BLOW COUNTS	N VALUE	GRAPHIC LOG	MATERIAL DESCRIPTION	LIQUID PLASTIC LIMITS	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
	1		2 5 6	8		Gray fine sand, trace roots (SP)				
	2		6 7 8	15		2.5 Light gray fine sand, trace roots (SP)				
	3		7 6 5	12		▽ 5.0 Dark gray fine sand, trace roots (SP)				
	4		5 5 5	11		6.5 Brown fine sand, little silt (SP-SM)				
	5		5 5 6	10		8.5 Brown fine sand (SP)				
	6		4 3 4	7		13.5 Dark brown fine sand (SP)				
	7		3 3 2	5		18.5 Brown fine sand (SP)				
	8		3 3 3	6		23.5 Gray fine sand (SP)				
25						25.0 Bottom of borehole at 25.0 feet.				

SPT LOGS - GFA DATA TEMPLATE.GDT - 9/27/23 18:11 - G:\PROJECTS\UES PROJECT SETUP\2021 UES PROJECTS\3330.2100102.0000 - COSTCO KANNER HIGHWAY PUD - GEO\17-4455.01 - COSTCO - STUART - GEOGEO - RESIDENTIAL BUILDINGS\APPENDIC



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CLIENT	M&M Stuart, LLC.	PROJECT NAME	Costco Kanner Highway		
PROJECT NUMBER	3330.2100102.0000	PROJECT LOCATION	S Kanner Highway, Stuart, Florida		
DRILLING CONTRACTOR	Universal Engineering Sciences	HOLE DEPTH	25 ft	HOLE DIAMETER	3 in
DRILLER	CS/JB/SC	DATE STARTED	9/22/23	COMPLETED	9/22/23
DRILL RIG	CME-45	GROUND WATER LEVEL: ∇ AT TIME OF DRILLING	5.50 ft		
METHOD	SPT	LATITUDE	27.167279	LONGITUDE	-80.245324
NOTE:	HAMMER TYPE				

DEPTH (ft)	SAMPLE TYPE SAMPLE NUMBER	% RECOVERY (RQD)	BLOW COUNTS	N VALUE	GRAPHIC LOG	MATERIAL DESCRIPTION	LIQUID PLASTIC LIMITS	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
	1		3 5 7 8	12		Light gray fine sand (SP)				
	2		9 11 12 10	23						
5	3		7 7 7 8	14	4.5	Brown fine sand, little clay (SP-SC)				
	4		4 4 4 5	8	6.5	Light brown fine sand, little silt (SP-SM)				
	5		4 4 4 4	8	8.5	Light brown fine sand (SP)				
10										
	6		3 4 4	8	13.5	Gray fine sand (SP)				
15										
	7		5 7 6	13						
20										
	8		4 4 5	9	25.0					
25										

Bottom of borehole at 25.0 feet.



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CLIENT <u>M&M Stuart, LLC.</u>	PROJECT NAME <u>Costco Kanner Highway</u>
PROJECT NUMBER <u>3330.2100102.0000</u>	PROJECT LOCATION <u>S Kanner Highway, Stuart, Florida</u>
DRILLING CONTRACTOR <u>Universal Engineering Sciences</u>	HOLE DEPTH <u>25 ft</u> HOLE DIAMETER <u>3 in</u>
DRILLER <u>CS/JB/SC</u>	DATE STARTED <u>9/22/23</u> COMPLETED <u>9/22/23</u>
DRILL RIG <u>CME-45</u>	GROUND WATER LEVEL: <u>▽ AT TIME OF DRILLING</u> <u>5.40 ft</u>
METHOD <u>SPT</u>	LATITUDE <u>27.167498</u> LONGITUDE <u>-80.245595</u>
NOTE: _____	HAMMER TYPE _____

DEPTH (ft)	SAMPLE TYPE SAMPLE NUMBER	% RECOVERY (RQD)	BLOW COUNTS	N VALUE	GRAPHIC LOG	MATERIAL DESCRIPTION	LIQUID PLASTIC LIMITS	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
	1		2 3 4 5	7		Brown fine sand, little silt (SP-SM) 2.0				
	2		6 7 8 8	15		Light gray fine sand (SP)				
5	3		7 8 8 9	16		5.0 ▽ Brown fine sand, little clay (SP-SC)				
	4		8 7 5 5	12		7.5				
	5		4 5 4 5	9		Light brown fine sand (SP)				
10										
	6		4 4 5	9		13.5 Gray-brown fine sand (SP)				
15										
	7		4 5 5	10		18.5 Brown fine sand (SP)				
20										
	8		4 4 4	8		25.0				
25						Bottom of borehole at 25.0 feet.				



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CLIENT M&M Stuart, LLC. **PROJECT NAME** Costco Kanner Highway

PROJECT NUMBER 3330.2100102.0000 **PROJECT LOCATION** S Kanner Highway, Stuart, Florida

DRILLING CONTRACTOR Universal Engineering Sciences **HOLE DEPTH** 25 ft **HOLE DIAMETER** 3 in

DRILLER CS/JB/SC **DATE STARTED** 9/22/23 **COMPLETED** 9/22/23

DRILL RIG CME-45 **GROUND WATER LEVEL: ∇ AT TIME OF DRILLING** 6.00 ft

METHOD SPT **LATITUDE** 27.167842 **LONGITUDE** -80.246359

NOTE: **HAMMER TYPE**

DEPTH (ft)	SAMPLE TYPE SAMPLE NUMBER	% RECOVERY (RQD)	BLOW COUNTS	N VALUE	GRAPHIC LOG	MATERIAL DESCRIPTION	LIQUID PLASTIC LIMITS	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
	1		2 5 7	8		Light gray fine sand (SP)				
	2		7 7 7	15						
5	3		6 7 8 11	15		5.0 ∇ Brown fine sand, little clay (SP-SC)				
	4		9 5 5 4	10		8.0				
	5		4 4 6 6	10		Gray fine sand, little silt (SP-SM)				
10										
	6		4 4 7	11		13.5 Gray-brown fine sand (SP)				
15										
	7		5 6 8	14		18.5 Brown fine sand (SP)				
20										
	8		4 4 5	9		25.0				
25						Bottom of borehole at 25.0 feet.				

SPT LOGS - GFA DATA TEMPLATE.GDT - 9/27/23 18:11 - G:\PROJECTS\UES PROJECT SETUP\2021 UES PROJECTS\3330.2100102.0000 - COSTCO KANNER HIGHWAY PUD - GEO\17-4455.01 - COSTCO - STUART - GEO\GEO - RESIDENTIAL BUILDINGS\APPENDIC



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LOG OF BORING R-18

PAGE 1 OF 1

CLIENT	M&M Stuart, LLC.	PROJECT NAME	Costco Kanner Highway		
PROJECT NUMBER	3330.2100102.0000	PROJECT LOCATION	S Kanner Highway, Stuart, Florida		
DRILLING CONTRACTOR	Universal Engineering Sciences	HOLE DEPTH	25 ft	HOLE DIAMETER	3 in
DRILLER	CS/BS	DATE STARTED	9/21/23	COMPLETED	9/21/23
DRILL RIG	CME-45	GROUND WATER LEVEL: ∇ AT TIME OF DRILLING	6.00 ft		
METHOD	SPT	LATITUDE	27.167767	LONGITUDE	-80.246773
NOTE:	HAMMER TYPE				

DEPTH (ft)	SAMPLE TYPE SAMPLE NUMBER	% RECOVERY (RQD)	BLOW COUNTS	N VALUE	GRAPHIC LOG	MATERIAL DESCRIPTION	LIQUID PLASTIC LIMITS	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
	1		1 2 5 8	7		Gray fine sand (SP)				
	2		8 9 10 8	19		2.0 Light gray fine sand (SP)				
5	3		5 5 6 9	11		5.5 ∇ Dark brown fine sand, little silt, trace organics (SP-SM)				
	4		7 7 6 5	13		7.0 Dark brown fine sand, trace organics (SP)		16.5	8.1	5.0
	5		5 5 4 4	9		8.5 Brown fine sand (SP)				
10										
	6		3 3 3 3	6		13.5 Light brown fine sand (SP)				
15										
	7		3 3 3 3	6		18.5 Brown fine sand (SP)				
20										
	8		3 3 3 3	6		25.0				
25										

Bottom of borehole at 25.0 feet.

HAND AUGER WITH HOP - GFA DATA TEMPLATE.GDT - 9/18/23 16:43 - V:\PROJECTS\ UES PROJECT SETUP\2021 UES PROJECTS\3330.2100102.0000 - COSTCO KANNER HIGHWAY PUD - GEO\17-4455.01 - COSTCO - STUART - GEO\GEO - RESIDENTIAL BUILDING



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LOG OF BORING P-1

CLIENT M&M Stuart, LLC.

PROJECT NUMBER 3330.2100102.0000

DATE STARTED 7/5/23 COMPLETED 7/5/23

DRILLING CONTRACTOR Universal Engineering Sciences

DRILLING METHOD Auger Boring

DRILLER RV/JQ

NOTES

PROJECT NAME Costco Kanner Highway

PROJECT LOCATION S Kanner Highway, Stuart, Florida

LATITUDE 27.165535 LONGITUDE -80.248685

GROUND WATER LEVELS:
▽ AT TIME OF DRILLING 5.00 ft

AT END OF ---

ESHGT

DEPTH (ft)	HAND CONE PENETROMETER (HCP)	GRAPHIC LOG	MATERIAL DESCRIPTION	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
0						
80			Gray fine sand (SP)			
80			2.0			
80			Light gray fine sand (SP)			
80						
5			5.0 ▽			
80			Brown fine sand (SP)			
80			6.0			

Bottom of borehole at 6.0 feet.

HAND AUGER WITH HOP - GFA DATA TEMPLATE.GDT - 9/18/23 16:43 - V:\PROJECTS\ UES PROJECT SETUP\2021 UES PROJECTS\3330.2100102.0000 - COSTCO KANNER HIGHWAY PUD - GEO\17-4455.01 - COSTCO - STUART - GEO\GEO - RESIDENTIAL BUILDING



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LOG OF BORING P-2

CLIENT	M&M Stuart, LLC.	PROJECT NAME	Costco Kanner Highway
PROJECT NUMBER	3330.2100102.0000	PROJECT LOCATION	S Kanner Highway, Stuart, Florida
DATE STARTED	6/30/23	COMPLETED	6/30/23
DRILLING CONTRACTOR	Universal Engineering Sciences	LATITUDE	27.165622
DRILLING METHOD	Auger Boring	LONGITUDE	-80.24942
DRILLER	RV/MR/MP	GROUND WATER LEVELS:	
NOTES		AT TIME OF DRILLING	--- Not Encountered
		AT END OF	---
		ESHGT	

DEPTH (ft)	HAND CONE PENETROMETER (HCP)	GRAPHIC LOG	MATERIAL DESCRIPTION	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
0						
80			Gray fine sand (SP)			
80						
70			Dark brown fine sand with little silt, trace fine roots (SP-SM)			
70						
70			Brown fine sand (SP)			
5						
70						

Bottom of borehole at 6.0 feet.

HAND AUGER WITH HOP - GFA DATA TEMPLATE.GDT - 9/18/23 16:44 - V:\PROJECTS\ UES PROJECT SETUP\2021 UES PROJECTS\3330.2100102.0000 - COSTCO KANNER HIGHWAY PUD - GEO\17-4455.01 - COSTCO - STUART - GEO\GEO - RESIDENTIAL BUILDING



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LOG OF BORING P-3

CLIENT	M&M Stuart, LLC.	PROJECT NAME	Costco Kanner Highway
PROJECT NUMBER	3330.2100102.0000	PROJECT LOCATION	S Kanner Highway, Stuart, Florida
DATE STARTED	6/30/23	COMPLETED	6/30/23
DRILLING CONTRACTOR	Universal Engineering Sciences	LATITUDE	27.166528
DRILLING METHOD	Auger Boring	LONGITUDE	-80.249377
DRILLER	RV/MR/MP	GROUND WATER LEVELS:	
NOTES		AT TIME OF DRILLING	--- Not Encountered
		AT END OF	---
		ESHGT	

DEPTH (ft)	HAND CONE PENETROMETER (HCP)	GRAPHIC LOG	MATERIAL DESCRIPTION	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
0						
80			Gray fine sand (SP)			
80						
80			Dark brown fine sand with little silt (SP-SM)			
80						
5						
80						
80			Gray fine sand (SP)			

Bottom of borehole at 6.0 feet.

HAND AUGER WITH HOP - GFA DATA TEMPLATE.GDT - 9/18/23 16:44 - V:\PROJECTS\ UES PROJECT SETUP\2021 UES PROJECTS\3330.2100102.0000 - COSTCO KANNER HIGHWAY PUD - GEO\17-4455.01 - COSTCO - STUART - GEO\GEO - RESIDENTIAL BUILDING



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LOG OF BORING P-4

CLIENT M&M Stuart, LLC.

PROJECT NUMBER 3330.2100102.0000

DATE STARTED 7/5/23 COMPLETED 7/5/23

DRILLING CONTRACTOR Universal Engineering Sciences

DRILLING METHOD Auger Boring

DRILLER RV/JQ

NOTES

PROJECT NAME Costco Kanner Highway

PROJECT LOCATION S Kanner Highway, Stuart, Florida

LATITUDE 27.165978 LONGITUDE -80.248157

GROUND WATER LEVELS:
▽ AT TIME OF DRILLING 4.00 ft

AT END OF ---

ESHGT

DEPTH (ft)	HAND CONE PENETROMETER (HCP)	GRAPHIC LOG	MATERIAL DESCRIPTION	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
0						
80			Dark gray fine sand (SP)			
80			Light gray fine sand (SP)			
80						
80			▽			
5						
80						
80			Dark brown organically stained fine sand with little silt (SP-SM)			

Bottom of borehole at 6.0 feet.

HAND AUGER WITH HOP - GFA DATA TEMPLATE.GDT - 9/18/23 16:44 - V:\PROJECTS\ UES PROJECT SETUP\2021 UES PROJECTS\3330.2100102.0000 - COSTCO KANNER HIGHWAY PUD - GEO\17-4455.01 - COSTCO - STUART - GEO\GEO - RESIDENTIAL BUILDING



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LOG OF BORING P-5

CLIENT	M&M Stuart, LLC.	PROJECT NAME	Costco Kanner Highway
PROJECT NUMBER	3330.2100102.0000	PROJECT LOCATION	S Kanner Highway, Stuart, Florida
DATE STARTED	7/5/23	COMPLETED	7/5/23
DRILLING CONTRACTOR	Universal Engineering Sciences	LATITUDE	27.166689
DRILLING METHOD	Auger Boring	LONGITUDE	-80.248548
DRILLER	RV/JQ	GROUND WATER LEVELS:	
NOTES		▽ AT TIME OF DRILLING 5.00 ft	
		AT END OF ---	
		ESHGT	

DEPTH (ft)	HAND CONE PENETROMETER (HCP)	GRAPHIC LOG	MATERIAL DESCRIPTION	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
0						
80			Gray fine sand (SP)			
80			2.0			
80			Light gray fine sand (SP)			
80						
5			5.0 ▽			
80			Brown fine sand (SP)			
80			6.0			

Bottom of borehole at 6.0 feet.

HAND AUGER WITH HOP - GFA DATA TEMPLATE.GDT - 9/18/23 16:44 - V:\PROJECTS\ UES PROJECT SETUP\2021 UES PROJECTS\3330.2100102.0000 - COSTCO KANNER HIGHWAY PUD - GEO\17-4455.01 - COSTCO - STUART - GEO\GEO - RESIDENTIAL BUILDING



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LOG OF BORING P-6

CLIENT M&M Stuart, LLC.

PROJECT NUMBER 3330.2100102.0000

DATE STARTED 7/5/23 COMPLETED 7/5/23

DRILLING CONTRACTOR Universal Engineering Sciences

DRILLING METHOD Auger Boring

DRILLER RV/JQ

NOTES

PROJECT NAME Costco Kanner Highway

PROJECT LOCATION S Kanner Highway, Stuart, Florida

LATITUDE 27.166971 LONGITUDE -80.247799

GROUND WATER LEVELS:
▽ AT TIME OF DRILLING 5.00 ft

AT END OF ---

ESHGT

DEPTH (ft)	HAND CONE PENETROMETER (HCP)	GRAPHIC LOG	MATERIAL DESCRIPTION	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
0						
80			Dark gray fine sand, trace fine roots (SP)			
80			Light gray fine sand (SP)			
80						
80						
5			Brown fine sand, trace fine roots (SP)			
80			▽			
80						
			6.0			

Bottom of borehole at 6.0 feet.

HAND AUGER WITH HOP - GFA DATA TEMPLATE.GDT - 9/18/23 16:44 - V:\PROJECTS\ UES PROJECT SETUP\2021 UES PROJECTS\3330.2100102.0000 - COSTCO KANNER HIGHWAY PUD - GEO\17-4455.01 - COSTCO - STUART - GEO\GEO - RESIDENTIAL BUILDING



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LOG OF BORING P-7

CLIENT	M&M Stuart, LLC.	PROJECT NAME	Costco Kanner Highway
PROJECT NUMBER	3330.2100102.0000	PROJECT LOCATION	S Kanner Highway, Stuart, Florida
DATE STARTED	7/5/23	COMPLETED	7/5/23
DRILLING CONTRACTOR	Universal Engineering Sciences	LATITUDE	27.167128
DRILLING METHOD	Auger Boring	LONGITUDE	-80.247064
DRILLER	RV/JQ	GROUND WATER LEVELS:	
NOTES		▽ AT TIME OF DRILLING 5.00 ft	
		AT END OF ---	
		ESHGT	

DEPTH (ft)	HAND CONE PENETROMETER (HCP)	GRAPHIC LOG	MATERIAL DESCRIPTION	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
0						
80			Dark gray fine sand (SP)			
80			Light gray fine sand (SP)			
80						
80						
5			Brown fine sand, trace fine roots (SP)			
80			▽			
80						

Bottom of borehole at 6.0 feet.

SPT LOGS - GFA DATA TEMPLATE.GDT - 9/18/23 16:42 - V:\PROJECTS\UES PROJECT SETUP\2021 UES PROJECTS\3330.2100102.0000 - COSTCO KANNER HIGHWAY PUD - GEO\17-4455.01 - COSTCO - STUART - GEO\GEO - RESIDENTIAL BUILDINGS\APPENDICE



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LOG OF BORING P-8

CLIENT M&M Stuart, LLC.

PROJECT NUMBER 3330.2100102.0000

DRILLING CONTRACTOR Universal Engineering Sciences

DRILLER CS/BS

DRILL RIG CME-45

METHOD SPT

NOTE: _____

PROJECT NAME Costco Kanner Highway

PROJECT LOCATION S Kanner Highway, Stuart, Florida

HOLE DEPTH 6 ft HOLE DIAMETER 3 in

DATE STARTED 7/5/23 COMPLETED 7/5/23

GROUND WATER LEVEL: ▽ AT TIME OF DRILLING 2.50 ft

LATITUDE 27.167762 LONGITUDE -80.247054

HAMMER TYPE _____

DEPTH (ft)	SAMPLE TYPE SAMPLE NUMBER	% RECOVERY (RQD)	BLOW COUNTS	N VALUE	GRAPHIC LOG	MATERIAL DESCRIPTION	LIQUID PLASTIC LIMITS	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
	1		2 4 5 7	9		Light gray fine sand (SP)				
	2		6 8 8 9	16		▽ 4.0				
5	3		5 4 4 4	8		Light brown fine sand, some clay, trace fine root (SC) 6.0				

Bottom of borehole at 6.0 feet.

SPT LOGS - GFA DATA TEMPLATE.GDT - 9/18/23 16:42 - V:\PROJECTS\UES PROJECT SETUP\2021 UES PROJECTS\3330.2100102.0000 - COSTCO KANNER HIGHWAY PUD - GEO\17-4455.01 - COSTCO - STUART - GEO\GEO - RESIDENTIAL BUILDINGS\APPENDICE



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LOG OF BORING P-9

CLIENT M&M Stuart, LLC.

PROJECT NUMBER 3330.2100102.0000

DRILLING CONTRACTOR Universal Engineering Sciences

DRILLER CS/BS

DRILL RIG CME-45

METHOD SPT

NOTE: _____

PROJECT NAME Costco Kanner Highway

PROJECT LOCATION S Kanner Highway, Stuart, Florida

HOLE DEPTH 6 ft HOLE DIAMETER 3 in

DATE STARTED 7/5/23 COMPLETED 7/5/23

GROUND WATER LEVEL: AT TIME OF DRILLING --- Not Encountered

LATITUDE 27.1675 LONGITUDE -80.246431

HAMMER TYPE _____

DEPTH (ft)	SAMPLE TYPE SAMPLE NUMBER	% RECOVERY (RQD)	BLOW COUNTS	N VALUE	GRAPHIC LOG	MATERIAL DESCRIPTION	LIQUID PLASTIC LIMITS	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
	1		1 3 5 7	8		Light gray fine sand (SP)				
	2		5 6 7 9	13						
5	3		4 5 4 5	9		4.5 Light brown fine sand, some clay, trace fine root (SC)				
					6.0					

Bottom of borehole at 6.0 feet.

SPT LOGS - GFA DATA TEMPLATE.GDT - 9/18/23 16:42 - V:\PROJECTS\UES PROJECT SETUP\2021 UES PROJECTS\3330.2100102.0000 - COSTCO KANNER HIGHWAY PUD - GEO\17-4455.01 - COSTCO - STUART - GEO\GEO - RESIDENTIAL BUILDINGS\APPENDICE



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LOG OF BORING P-10

CLIENT M&M Stuart, LLC.

PROJECT NUMBER 3330.2100102.0000

DRILLING CONTRACTOR Universal Engineering Sciences

DRILLER CS/BS

DRILL RIG CME-45

METHOD SPT

NOTE: _____

PROJECT NAME Costco Kanner Highway

PROJECT LOCATION S Kanner Highway, Stuart, Florida

HOLE DEPTH 6 ft HOLE DIAMETER 3 in

DATE STARTED 7/5/23 COMPLETED 7/5/23

GROUND WATER LEVEL: AT TIME OF DRILLING --- Not Encountered

LATITUDE 27.167731 LONGITUDE -80.245862

HAMMER TYPE _____

DEPTH (ft)	SAMPLE TYPE SAMPLE NUMBER	% RECOVERY (RQD)	BLOW COUNTS	N VALUE	GRAPHIC LOG	MATERIAL DESCRIPTION	LIQUID PLASTIC LIMITS	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
	1		2 4 5 7	9		Light gray fine sand (SP)				
	2		7 9 11 10	20						
5	3		8 6 6 5	12						
						5.5 6.0 Dark brown fine sand with little silt, trace fine root (SP-SM)				

Bottom of borehole at 6.0 feet.



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LOG OF BORING P-11

PAGE 1 OF 1

CLIENT <u>M&M Stuart, LLC.</u>	PROJECT NAME <u>Costco Kanner Highway</u>
PROJECT NUMBER <u>3330.2100102.0000</u>	PROJECT LOCATION <u>S Kanner Highway, Stuart, Florida</u>
DRILLING CONTRACTOR <u>Universal Engineering Sciences</u>	HOLE DEPTH <u>6 ft</u> HOLE DIAMETER <u>3 in</u>
DRILLER <u>CS/BS</u>	DATE STARTED <u>7/5/23</u> COMPLETED <u>7/5/23</u>
DRILL RIG <u>CME-45</u>	GROUND WATER LEVEL: AT TIME OF DRILLING <u>--- Not Encountered</u>
METHOD <u>SPT</u>	LATITUDE <u>27.167124</u> LONGITUDE <u>-80.245871</u>
NOTE: _____	HAMMER TYPE _____

DEPTH (ft)	SAMPLE TYPE SAMPLE NUMBER	% RECOVERY (RQD)	BLOW COUNTS	N VALUE	GRAPHIC LOG	MATERIAL DESCRIPTION	LIQUID PLASTIC LIMITS	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
1	1		22 6 8	8		Light gray fine sand (SP)				
2	2		9 8 11 11	19						
3	3		10 6 6 7	12						
5					6.0					

Bottom of borehole at 6.0 feet.

SPT LOGS - GFA DATA TEMPLATE.GDT - 9/18/23 16:42 - V:\PROJECTS\UES PROJECT SETUP\2021 UES PROJECTS\3330.2100102.0000 - COSTCO KANNER HIGHWAY PUD - GEO\17-4455.01 - COSTCO - STUART - GEO\GEO - RESIDENTIAL BUILDINGS\APPENDICE



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LOG OF BORING P-12

CLIENT M&M Stuart, LLC.

PROJECT NUMBER 3330.2100102.0000

DRILLING CONTRACTOR Universal Engineering Sciences

DRILLER CS/BS

DRILL RIG CME-45

METHOD SPT

NOTE: _____

PROJECT NAME Costco Kanner Highway

PROJECT LOCATION S Kanner Highway, Stuart, Florida

HOLE DEPTH 6 ft HOLE DIAMETER 3 in

DATE STARTED 7/5/23 COMPLETED 7/5/23

GROUND WATER LEVEL: AT TIME OF DRILLING --- Not Encountered

LATITUDE 27.166774 LONGITUDE -80.245495

HAMMER TYPE _____

DEPTH (ft)	SAMPLE TYPE SAMPLE NUMBER	% RECOVERY (RQD)	BLOW COUNTS	N VALUE	GRAPHIC LOG	MATERIAL DESCRIPTION	LIQUID PLASTIC LIMITS	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
	1		1 2 4 5	6		Light gray fine sand (SP)				
	2		6 7 9 9	16						
5	3		8 7 7 7	14		Brown organically stained fine sand with little silt (SP-SM)				

Bottom of borehole at 6.0 feet.

HAND AUGER WITH HOP - GFA DATA TEMPLATE.GDT - 8/17/23 08:57 - V:\PROJECTS\ UES PROJECT SETUP\2021 UES PROJECTS\3330.2100102.0000 - COSTCO KANNER HIGHWAY PUD - GEO\17-4455.01 - COSTCO - STUART - GEO\GEO - RESIDENTIAL BUILDING



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LOG OF BORING ST-1

CLIENT	M&M Stuart, LLC.	PROJECT NAME	Costco Kanner Highway		
PROJECT NUMBER	3330.2100102.0000	PROJECT LOCATION	S Kanner Highway, Stuart, Florida		
DATE STARTED	7/5/23	COMPLETED	7/5/23		
DRILLING CONTRACTOR	Universal Engineering Sciences	LATITUDE	27.166646	LONGITUDE	-80.244719
DRILLING METHOD	Auger Boring	GROUND WATER LEVELS:			
DRILLER	RV/JQ	▽ AT TIME OF DRILLING 5.00 ft			
NOTES		AT END OF ---			
		ESHGT			

DEPTH (ft)	HAND CONE PENETROMETER (HCP)	GRAPHIC LOG	MATERIAL DESCRIPTION	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
0						
80			Dark gray fine sand (SP)			
80			Light gray fine sand (SP)			
80						
80						
5						
80			Dark brown fine sand, trace organics (SP)			
80						

Bottom of borehole at 6.0 feet.

HAND AUGER WITH HOP - GFA DATA TEMPLATE.GDT - 8/17/23 08:57 - V:\PROJECTS\ UES PROJECT SETUP\2021 UES PROJECTS\3330.2100102.0000 - COSTCO KANNER HIGHWAY PUD - GEO\17-4455.01 - COSTCO - STUART - GEO\GEO - RESIDENTIAL BUILDING



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LOG OF BORING ST-2

CLIENT M&M Stuart, LLC.

PROJECT NUMBER 3330.2100102.0000

DATE STARTED 7/5/23 COMPLETED 7/5/23

DRILLING CONTRACTOR Universal Engineering Sciences

DRILLING METHOD Auger Boring

DRILLER RV/JQ

NOTES

PROJECT NAME Costco Kanner Highway

PROJECT LOCATION S Kanner Highway, Stuart, Florida

LATITUDE 27.166691 LONGITUDE -80.24522

GROUND WATER LEVELS:
▽ AT TIME OF DRILLING 5.00 ft

AT END OF ---

ESHGT

DEPTH (ft)	HAND CONE PENETROMETER (HCP)	GRAPHIC LOG	MATERIAL DESCRIPTION	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)
0						
80			Dark gray fine sand (SP)			
80			Light gray fine sand (SP)			
80						
80						
5						
80						
80						
			Dark brown organically stained fine sand with little silt (SP-SM)			

Bottom of borehole at 6.0 feet.

ESHGT

Bottom of borehole at 6.0 feet.

Appendix E - Hydraulic Conductivity Results



UNIVERSAL ENGINEERING SCIENCES

Consultants In: Geotechnical Engineering • Environmental Sciences
Geophysical Services • Construction Materials Testing • Threshold Inspection
Building Inspection • Plan Review • Building Code Administration

EXFILTRATION TEST REPORT

South Florida Water Management District - Usual Open Hole Test

Client: M&M Stuart, LLC

Project No: 3330.2100102.0000

Project: Costco Kanner Highway
S Kanner Highway, Stuart, Florida

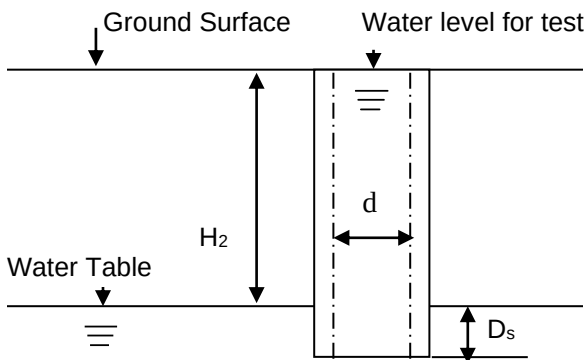
Test Date: 7/5/2023

Technician: RV/JQ

SOIL PROFILE

Test Location: EX-1	Depth (feet)	Soil Description	HCP
	0 – 1	Dark gray fine sand, trace fine roots (SP)	80+
	1 – 4	Light gray fine sand (SP)	80+
	4 – 5	Brown fine sand (SP)	80+
			70+
			70+
			70+
	Depth to Water Table from Ground Surface (feet)		4

CALCULATION OF HYDRAULIC CONDUCTIVITY



$$K = \frac{4Q}{\pi d(2H_2^2 + 4H_2D_s + H_2d)}$$

K	Hydraulic Conductivity (cfs/ ft ² – ft head)	1.30 x 10⁻⁰⁴
Q	Stabilized Flow Rate (cubic ft per second)	2.23 x 10⁻⁰³
d	Diameter of Test Hole (feet)	0.33
H₂	Depth to Water Table (feet)	4.0
D_s	Saturated Hole Depth (feet)	2.0
Notes:		



UNIVERSAL ENGINEERING SCIENCES

Consultants In: Geotechnical Engineering • Environmental Sciences
Geophysical Services • Construction Materials Testing • Threshold Inspection
Building Inspection • Plan Review • Building Code Administration

EXFILTRATION TEST REPORT

South Florida Water Management District - Usual Open Hole Test

Client: M&M Stuart, LLC

Project No: 3330.2100102.0000

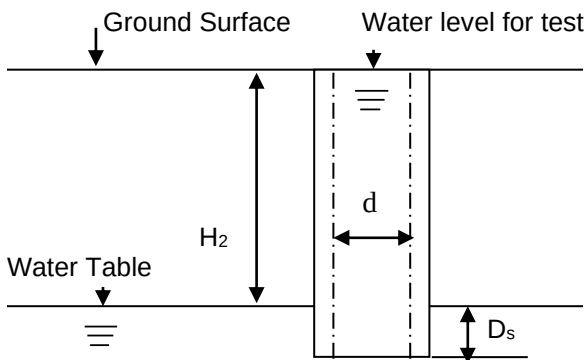
Project: Costco Kanner Highway
S Kanner Highway, Stuart, Florida

Test Date: 7/5/2023
Technician: RV/JQ

SOIL PROFILE

Test Location: EX-2	Depth (feet)	Soil Description	HCP
	0 – 2	Dark gray fine sand (SP)	80+
	2 – 5	Light gray fine sand (SP)	80+
	5 – 6	Brown fine sand (SP)	80+
			80+
			80+
			80+
	Depth to Water Table from Ground Surface (feet)		4

CALCULATION OF HYDRAULIC CONDUCTIVITY



$$K = \frac{4Q}{\pi d(2H_2^2 + 4H_2D_s + H_2d)}$$

K	Hydraulic Conductivity (cfs/ ft ² – ft head)	1.95 x 10⁻⁰⁴
Q	Stabilized Flow Rate (cubic ft per second)	3.34 x 10⁻⁰³
d	Diameter of Test Hole (feet)	0.33
H₂	Depth to Water Table (feet)	4.0
D_s	Saturated Hole Depth (feet)	2.0
Notes:		

Appendix F - Discussion of Soil Groups

DISCUSSION OF SOIL GROUPS

COARSE GRAINED SOILS

General. A soil is classified as coarse-grained if more than 50 percent of a representative sample of the material is retained on the No. 200 sieve.

GW and SW Groups. These groups comprise well-graded gravelly and sandy soils containing little or no plastic fines (less than 5 percent passing the No. 200 sieve). The low fines content does not noticeably change the shear strength characteristics of these soils and does not interfere with their free-draining characteristics.

GP and SP Groups. Poorly graded gravels and sands containing little or no plastic fines (less than 5 percent passing the No. 200 sieve) are in the GP and SP groups. The materials can be called uniform gravels, uniform sands, or non-uniform mixtures of very coarse materials and very fine sand, with intermediate sizes lacking (sometimes called skip-graded, gap-graded, or step-graded). This last group often results from borrow pit excavation in which gravel and sand layers are mixed.

GM and SM Groups. In general, the GM and SM groups comprise gravels or sands with fines (more than 12 percent passing the No. 200 sieve) having little or no plasticity. The plasticity index and liquid limit of soils in these groups plot below the “A” line on the plasticity chart. The gradation of the material is not considered significant and both well and poorly graded materials are included.

GC and SC Groups. In general, the GC and SC groups comprise gravelly or sandy soils containing fines (more than 12 percent passing the No. 200 sieve) having plasticity characteristics. The plasticity index and liquid limit of soils in these groups plot above the “A” line on the plasticity chart.

FINE GRAINED SOILS

General. A soil is classified as fine-grained if more than 50 percent of a representative sample of the material passes the No. 200 sieve.

ML and MH Groups. These groups comprise inorganic silts (ML) and elastic silts (MH) having either low (L) or high (H) liquid limits, respectively. ML soils have a liquid limit of less than 50 while MH soils have a liquid limit of 50 and greater. Silts and elastic silts can also contain varying amounts of sand and gravel. Also included in this group are loess sediments and rock flours.

CL and CH Groups. These groups comprise low plasticity (lean) clays (CL) and medium to high plasticity (fat) clays (CH) having either low (L) or high (H) liquid limits, respectively. CL soils have a liquid limit of less than 50 while CH soils have a liquid limit of 50 and greater. The low plasticity clays can also be sandy clays or silty clays. The moderate to high plasticity clays can also be sandy clays and include some volcanic clays.

OL and OH Groups. These groups comprise organic silts and clays. The soils are characterized by the presence of organic odor and/or dark color. The OL and OH soils are differentiated by determining and comparing their liquid limit values before and after oven drying representative soil samples.

HIGHLY ORGANIC SOILS

The highly organic soils are usually very soft and compressible and have undesirable construction characteristics. Particles of leaves, grasses, branches, or other fibrous vegetative matter are common components of these soils. They are not subdivided and are classified into one group with the symbol PT. Peat humus and swamp soils with a highly organic texture are typical soils of the group.

Appendix G - Historical Aerials

Historical Aerial: 1958



Source: <https://historicaerials.com/viewer>



Historical Aerial: 1958
Costco Kanner Highway PUD
S Kanner Highway, Stuart, FL

Project No: 17-4455.01

Reviewed By: EL

Drafted By: DS

Date: 09/28/2023.

Historical Aerial: 1968



Source: <https://historicaerials.com/viewer>



Historical Aerial: 1968
Costco Kanner Highway PUD
S Kanner Highway, Stuart, FL

Project No: 17-4455.01

Reviewed By: EL

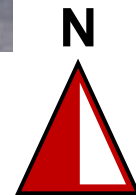
Drafted By: DS

Date: 09/28/2023.

Historical Aerial: 1984



Source: <https://historicaerials.com/viewer>



Historical Aerial: 1984
Costco Kanner Highway PUD
S Kanner Highway, Stuart, FL

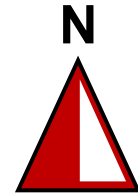
Project No: 17-4455.01

Reviewed By: EL

Drafted By: DS

Date: 09/28/2023.

Historical Aerial: 1995



Historical Aerial: 1995
Costco Kanner Highway PUD
S Kanner Highway, Stuart, FL

Project No: 17-4455.01

Reviewed By: EL

Drafted By: DS

Date: 09/28/2023.

Historical Aerial: 2003



Historical Aerial: 2003
Costco Kanner Highway PUD
S Kanner Highway, Stuart, FL

Project No: 17-4455.01

Reviewed By: EL

Drafted By: DS

Date: 09/28/2023.

Historical Aerial: 2009



Historical Aerial: 2009
Costco Kanner Highway PUD
S Kanner Highway, Stuart, FL

Project No: 17-4455.01

Reviewed By: EL

Drafted By: DS

Date: 09/28/2023.

Historical Aerial: 2012



Historical Aerial: 2012
Costco Kanner Highway PUD
S Kanner Highway, Stuart, FL

Project No: 17-4455.01

Reviewed By: EL

Drafted By: DS

Date: 09/28/2023.

Historical Aerial: 2019



Historical Aerial: 2019
Costco Kanner Highway PUD
S Kanner Highway, Stuart, FL

Project No: 17-4455.01

Reviewed By: EL

Drafted By: DS

Date: 09/28/2023.

Historical Aerial: 2023



Historical Aerial: 2023

Project No: 17-4455.01

Reviewed By: EL

Drafted By: DS

Date: 09/28/2023.